ORTEC®

ScintiVision™-32
for Windows® 2000 Professional and XP® Professional
MCA Emulation and Analysis Software for Scintillation Detector Spectra

A35-B32
Software User's Manual

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TABLE OF CONTENTS

1. INTRODUCTION 1
   1.1. MCA Emulation 2
   1.2. PC Requirements 3
   1.3. Detectors 3

2. INSTALLING SCINTIVISION-32 5
   2.1. If You Have Windows XP Service Pack 2 and Wish to Share Your Local ORTEC MCBs Across a Network 7
   2.2. Enabling Additional ORTEC Device Drivers 8

3. GETTING STARTED TUTORIAL 9
   3.1. Introduction 9
   3.2. Starting ScintiVision 10
      3.2.1. Recalling a Spectrum 11
      3.2.2. The Simplest Way To Do An Analysis 12
      3.2.3. Loading a Library 14
      3.2.4. Setting the Analysis Parameters 14
      3.2.5. Energy Calibration 18
      3.2.6. Efficiency Calibration 21
      3.2.7. Changing a Library 23
      3.2.8. Detector Setup 25
         3.2.8.1. Conversion Gain 26
         3.2.8.2. Detectors Set Up Manually 26
         3.2.8.3. Computer-Controlled Hardware Setup 26
         3.2.8.4. Amplifier Settings 27
            Automatic Pole Zero 27
            Adjusting Amplifier Gain 28

4. DISPLAY FEATURES 31
   4.1. Spectrum Displays 33
   4.2. The Toolbar 34
   4.3. Using the Mouse 36
      4.3.1. Moving the Marker with the Mouse 36
      4.3.2. The Right-Mouse-Button Menu 37
      4.3.3. Using the “Rubber Rectangle” 37
      4.3.4. Sizing and Moving the Full Spectrum View 38
   4.4. Buttons and Boxes 39
   4.5. Using the File Dialogs 40
      4.5.1. Changing Drive and Pathname 41
   4.6. Help 41
   4.7. Drag and Drop 42

4.8. Associated Files 43
4.9. Editing 43

5. MENU COMMANDS 45
5.1. File 48
5.1.1. Settings... 48
5.1.1.1. General 48
5.1.1.2. Export 50
Arguments: 50
Initial Directory 51
Run Options 52
5.1.1.3. Import 52
Arguments: 52
Initial Directory 53
Default 54
Run Options 54
5.1.1.4. Directories 54
5.1.2. Recall... 54
5.1.3. Save/Save As... 55
5.1.4. Export... 56
5.1.5. Import... 57
5.1.6. Print 57
5.1.7. Compare... 57
5.1.8. Exit 59
5.1.9. About ScintiVision... 59
5.2. Acquire 59
5.2.1. Acquisition Settings... 60
5.2.1.1. Start/Save/Report 60
5.2.1.2. Ask on Start Options 61
Sample Type Defaults 61
Acquisition Presets 61
Sample Description 61
Sample Quantity 61
Collection Date and Time 61
5.2.2. Start 62
5.2.3. Start/Save/Report 62
5.2.4. Stop 62
5.2.5. Clear 62
5.2.6. Copy to Buffer 62
5.2.7. QA 62
5.2.8. Download Spectra... 63
5.2.9. ZDT Display Select 63

5.2.10. MCB Properties... 64
5.2.10.1. DSPEC jr 2.0 65
Amplifier 65
Amplifier 2 67
Amplifier PRO 68
ADC 69
Stabilizer 70
High Voltage 70
About 71
Status 72
Presets 74
MDA Preset 76
5.2.10.2. digiBASE 77
Amplifier 77
Amplifier 2 77
ADC 78
Stabilizer 79
High Voltage 80
About 80
Status 81
Presets 81
5.2.10.3. InSight Mode 82
Mark Types 84
5.2.10.4. Gain Stabilization 85
5.2.10.5. Zero Stabilization 86
5.2.10.6. ZDT (Zero Dead Time) Mode 87
Choosing a ZDT Mode 90
The NORM_CORR Diagnostic Mode 90
More Information 91
5.2.10.7. Setting the Rise Time in Digital MCBs 91
5.3. Calibrate 93
5.3.1. Energy... 94
5.3.1.1. Introduction 94
5.3.1.2. Performing the Energy Calibration 95
5.3.1.3. Speeding Up Calibration with a Library 97
5.3.1.4. Using Multiple Spectra for a Single Calibration 99
5.3.2. Efficiency... 99
5.3.2.1. Introduction 99
5.3.2.2. Performing the Efficiency Calibration 102
Saving the Efficiency Calibration Table 104
Editing the Efficiency Calibration Table 104
5.3.2.3. Using The Library in Efficiency Calibrations 105

5.3.3. Description... 106
5.3.4. Lower Limit 107
5.3.5. Learn Calibration Sequence... 107
5.3.6. Run Calibration Sequence... 110
5.3.7. Recall Calibration... 111
5.3.8. Save Calibration... 111
5.3.9. Print Calibration... 112
5.4. Calculate 112
5.4.1. Settings... 112
5.4.2. Peak Info 113
5.4.3. Input Count Rate 115
5.4.4. Sum 115
5.4.5. Smooth 116
5.4.6. Strip... 116
5.5. Analyze 117
5.5.1. Settings 117
5.5.1.1. Sample Type... 117
Sample Tab 118
System Tab 119
Report Tab 121
Analysis Tab 122
Corrections Tab 124
5.5.1.2. Attenuation Coefficients 125
5.5.1.3. Peak Background Correction 129
Select PBC... 130
Edit PBC... 130
5.5.2. Entire Spectrum in Memory... 134
5.5.3. Spectrum on Disk... 135
5.5.4. Display Analysis Results... 135
5.5.5. Interactive in viewed area... 140
5.6. Library 142
5.6.1. Select Peak... 143
5.6.2. Select File... 143
5.6.3. Edit... 144
5.6.3.1. Copying Nuclides From Library to Library 145
5.6.3.2. Creating a New Library Manually 146
5.6.3.3. Editing Library List Nuclides 146
Manually Adding Nuclides 147
Deleting Nuclides from the Library 148
Rearranging the Library List 148
Editing Nuclide Peaks 148
Adding Nuclide Peaks 149

Rearranging the Peak List 149
5.6.3.4. Saving or Canceling Changes and Closing 149
5.6.4. List... 150
5.7. Services 150
5.7.1. JOB Control... 150
5.7.2. Sample Description... 151
5.7.3. Menu Passwords... 151
5.7.4. Lock/Unlock Detectors... 153
5.7.5. Edit Detector List... 154
5.8. ROI 155
5.8.1. Off 155
5.8.2. Mark 155
5.8.3. UnMark 155
5.8.4. Mark Peak 156
5.8.5. Clear 156
5.8.6. Clear All 156
5.8.7. Save File... 156
5.8.8. Recall File... 157
5.9. Display 157
5.9.1. Detector... 157
5.9.2. Detector/Buffer 159
5.9.3. Zoom In 159
5.9.4. Zoom Out 159
5.9.5. Logarithmic 159
5.9.6. Automatic 159
5.9.7. Baseline Zoom 160
5.9.8. Center 160
5.9.9. Full View 160
5.9.10. Preferences... 160
5.9.10.1. Points/Fill ROI/Fill All 160
5.9.10.2. Fill Singlets/Fill Multiplet Peaks/Fill Multiplet Composites 161
5.9.10.3. Spectrum Colors... 161
5.9.10.4. Peak Info Font/Color 162
5.10. Right-Mouse-Button Menu 163
5.10.1. Start 163
5.10.2. Stop 163
5.10.3. Clear 163
5.10.4. Copy to Buffer 163
5.10.5. Zoom In 163
5.10.6. Zoom Out 164
5.10.7. Undo Zoom In 164
5.10.8. Mark ROI 164

5.10.9. Clear ROI 164
5.10.10. Peak Info 164
5.10.11. Input Count Rate 165
5.10.12. Sum 165
5.10.13. MCB Properties... 165

6. ANALYSIS METHODS 167
6.1. Peak Search 167
6.1.1. Peak Search Algorithm 168
6.1.2. Background Method and Initial Peak Estimates 168
6.1.3. Peak Statistics 169
6.1.4. Critical Level/Peak Rejection Criteria 169
6.2. Peak Fitting 170
6.2.1. Background Fit 170
6.2.1.1. Linear Backgrounds 170
Singlets 170
Multiplets 171
Polynomial backgrounds 172
Sparse peak regions 172
6.2.2. The Peak Fit 172
6.2.2.1. Adding and Removing Peaks 173
6.2.2.2. Directed Fit Method 173
6.3. Library-Based Peak Stripping 174
6.4. Peak Identification 175
6.4.1. Peak Identification 175
6.4.2. Fraction Limit Test 175
6.4.3. Decay Limit Test 176
6.4.4. Nuclide Activity 176
6.4.5. Statistical Detection Limits 177
6.4.5.1. MDA (Minimum Detectable Activity) 177
6.5. Peak Background Correction 178

7. THE REPORT 179
7.1. First Page 179
7.2. Unidentified Peak Summary 182
7.3. Identified Peak Summary 184
7.4. Library Peak Usage 185
7.5. Summary of Nuclides in Sample 187

8. QUALITY ASSURANCE 189
8.1. Settings... 190
8.1.1. Establishing QA Settings 190

8.1.2. Creating the QA Database 193
8.2. Measure Background 195
8.3. Measure Sample 196
8.4. Status... 196
8.5. Control Charts... 197

9. KEYBOARD FUNCTIONS 201
9.1. Introduction 201
9.2. Marker and Display Function Keys 201
9.2.1. Next Channel 201
9.2.2. Next ROI 204
9.2.3. Next Peak 204
9.2.4. Next Library Entry 204
9.2.5. First/Last Channel 204
9.2.6. Jump (Sixteenth Screen Width) 205
9.2.7. Insert ROI 205
9.2.8. Clear ROI 205
9.2.9. Taller/Shorter 205
9.2.10. Move Rubber Rectangle One Pixel 206
9.2.11. Compare Vertical Separation 206
9.2.12. Zoom In/Zoom Out 206
9.2.13. Fine Gain 206
9.2.14. Fine Gain (Large Move) 206
9.2.15. Screen Capture 207
9.3. Keyboard Number Combinations 207
9.3.1. Start 207
9.3.2. Stop 207
9.3.3. Clear 207
9.3.4. Copy to Buffer 208
9.3.5. Detector/Buffer 208
9.3.6. Narrower/Wider 208
9.4. Function Keys 208
9.4.1. ROI 208
9.4.2. ZDT/Normal 209
9.4.3. ZDT Compare 209
9.4.4. Detector/Buffer 209
9.4.5. Taller/Shorter 209
9.4.6. Narrower/Wider 209
9.4.7. Select Detector 209
9.5. Keypad Keys 210
9.5.1. Log/Linear 210
9.5.2. Auto/Manual 210

9.5.3. Center 210
9.5.4. Zoom In/Zoom Out 210
9.5.5. Fine Gain 210

10. JOB FILES 211
10.1. Summary of JOB Commands 212
10.2. .JOB File Variables 218
10.3. JOB Programming Example 219
10.3.1. Improving the JOB 221
10.4. JOB Command Details 223

11. UTILITIES 241
11.1. WINPLOTS 241
11.1.1. File 242
11.1.2. Options 244
11.1.2.1. Plot... 244
ROI 245
Text 245
Horizontal 245
Vertical 246
11.1.3. Command Line Interface 246
11.2. TRANSLT 247

APPENDIX A. STARTUP AND CONFIGURATION 249
A.1. Startup 249
A.1.1. Command Line Options 249
A.2. Analysis Setup 250
A.2.1. GSA Program 251
A.2.2. G30WINDS.INI 251

APPENDIX B. FILE FORMATS 255
B.1. ScintiVision File Types 255
B.1.1. DetectorPATH Files 255
B.1.2. Spectrum Files 255
B.1.3. Miscellaneous Analysis, Calibration, Library, and Text Files 255
B.1.4. QA Database Files 256
B.2. Database Tables for ScintiVision QA 256
B.2.1. QA Detectors Detector Table 256
B.2.2. Application Information Table 257
B.2.3. M...d Measurements Table(s) 257
B.2.4. P...dmmmm Peaks Table(s) 258
B.3. Program Examples 258

B.3.1. FORTRAN Language 258
B.3.1.1. CHN Files 259
B.3.1.2. ROI Files 260
B.3.2. C Language 261

APPENDIX C. JOB FILE ERROR MESSAGES 263

INDEX 277

NOTE!

We assume that you are thoroughly familiar with 32-bit Microsoft® Windows® usage and terminology. If you are not fully acquainted with the Windows environment, including the use of the mouse, ***we strongly urge you to read the Microsoft documentation supplied with your Windows software and familiarize yourself with a few simple applications before proceeding.***

The convention used in this manual to represent actual keys pressed is to enclose the key label within angle brackets; for example, **<F1>**. For key combinations, the key labels are joined by a + within the angle brackets; for example, **<Alt + 2>**.

INSTALLATION

See page 5 for installation and configuration instructions, including hardware driver activation, network protocol configuration, and building the master list of instruments for **Scinti-Vision-32**.

If you are installing a new multichannel buffer (MCB) in addition to **ScintiVision-32**, or if your MCB and/or new **ScintiVision-32** is accompanied by a CONNECTIONS-32 Driver Update Kit (Part No. 797230), be sure to follow the installation instructions that accompany the Driver Update Kit, with the exception defined in the NOTE on manual page 5.

The tutorial begins on page 9.

1. INTRODUCTION

Welcome to ORTEC's ScintiVision-32, an integrated multichannel analyzer (MCA) emulator and gamma-spectrum analysis program for 32-bit Microsoft Windows operating systems. Our advanced MCA emulation and interactive analysis give you complete control over the collection and analysis of scintillator (sodium iodide [NaI]) gamma-ray spectra. ScintiVision incorporates the latest advances in analytical accuracy with user friendliness and the widest range of tools and corrections available to the spectroscopist. These include absorption correction, commands that allow you to edit nuclide libraries in either ScintiVision or NuclideNavigator III (Microsoft Access®) format, and the ability to use NuclideNavigator libraries as master libraries (but not analysis libraries). In addition, all hardware setup including presets, acquisition settings, and multichannel buffer (MCB) settings, is now performed in one dialog. The multi-nuclide MDA preset is available for the DSPEC Plus and other new MCBs. Multiple windows allow you to view several spectra at once for easy comparison or to monitor the acquisition of several sample spectra.

ScintiVision has numerous automation features, including powerful automated command sequences or "job streams." You can even create a desktop icon for a particular data collection and analysis job stream — one double-click that runs the entire procedure. All sample analyses can be controlled from a single screen, even across a network. Remote PC workstations can control, analyze, and view the data being gathered in the counting room.

ScintiVision is designed to analyze spectra generated by any ORTEC MCB directly from the spectrum on display or from spectrum files on disk in any of several file formats including the advanced and archivable **`.SPC`** format. In addition, ScintiVision now includes the capability to directly read and write spectral data files in the **`.SPE`** ASCII file format.

This release of ScintiVision offers two analysis engines. In the primary analysis method, a library-directed peak search delivers lower detection limits than can be achieved by "unguided" peak searches. This method is ideally suited for the determination of low-level and ultra-low-level samples (where statistics might be poor) for a specified list of contaminants. The interactive re-analysis mode lets you repeatedly re-fit the spectrum while monitoring the fit residuals. This is invaluable for highly complex spectral analyses such as certain neutron-activation and reactor-coolant spectra. A "directed fit" option lets you report negative activity values if calculated, as required for some effluent analysis requirements.

After analysis, evaluate the results using the flexible, easy-to-read ScintiVision report or a variety of informative, onscreen graphing routines. For custom-configured reports, we offer the optional ScintiVision Report Writer (A46-B32), which uses an Access-format database and Seagate® Crystal Reports®.

Regulatory compliance is easy with ScintiVision. The software's quality assurance (QA) features monitor system performance and store the results in an Access database. All hardware and analysis parameters are saved with the spectral data to ensure traceability.

ScintiVision's extensive menus and toolbar let you operate all aspects of data acquisition and analysis including calibration, library editing, computer-controlled hardware setup, and analysis parameter setup; as well as numerous onscreen data manipulation, comparison, and analysis tools.

Password protection allows you to secure both operator menus and access to hardware controls. All menu commands can be password-protected.

1.1. MCA Emulation

An MCA, in its most basic form, is an instrument that sorts and counts events in real time. This sorting is based on some characteristic of these events, and the events are grouped together into bins for counting purposes called *channels.* The most common type of multichannel analysis, and the one of greatest interest to nuclear spectroscopists, is *pulse-height analysis* (PHA). PHA events are signal pulses originating from a detector,[1] and the characteristic of interest is the pulse height or voltage, which is proportional to the particle or photon energy. An *analog-to-digital converter* (ADC) is used to convert each pulse into a channel number, so that each channel corresponds to a narrow range of pulse heights or voltages. As pulses arrive over time, the MCA will collect in memory a distribution of the count of pulses with respect to pulse height (a series of memory locations, corresponding to ADC channels, will contain the count of pulses of similar, although not necessarily identical, height). This distribution, arranged in order of ascending energies, is commonly referred to as a *spectrum.* To be useful, the acquired spectrum must be available for storage and/or analysis, and is displayed on a graph whose horizontal axis represents the height of the pulse and whose vertical axis represents the number of pulses at that height, also referred to as a *histogram.*

An important part of ScintiVision emulates an MCA with remarkable power and flexibility when combined with multichannel buffer (MCB) hardware (Detector interface) and a PC. The MCB performs the actual pulse-height analysis, while the computer and operating system make available the display facility and data-archiving hardware and drivers. The ScintiVision software is the vital link that marries these components to provide meaningful access to the MCB via the user interface provided by the computer hardware.

[1]In this manual "Detector" (capitalized) means the transducer (high-purity germanium, sodium iodide, silicon surface barrier, or others) plus all the electronics including the analog-to-digital converter and histogram memory. The transducers are referenced by the complete name; e.g., high-purity germanium (HPGe) detector.

The ScintiVision MCA emulation continuously shows the currently acquiring spectra, the current operating conditions, and the available menus. All important operations that need to be performed on a spectrum, such as peak location, insertion of *regions of interest* (ROIs), display scaling, and sizing are implemented with both the keyboard (accelerators) and the mouse (menus and toolbars). Some menu functions have more than one accelerator so that both new and experienced users will find the system easy to use.

ScintiVision maintains one or more *buffers* in the computer memory, to which spectra can be moved from the Detector memory for display and analysis while another spectrum is collected in the Detector. As much as possible, a buffer duplicates in memory the functions of the Detector hardware on which a spectrum was collected. Also, data can be analyzed directly in the Detector hardware memory, as well as stored directly from the Detector to disk.

1.2. PC Requirements

ScintiVision is designed for use on PCs that run Microsoft Windows 2000 Professional SP4 or XP SP2 or higher. For PCs with a legacy memory-mapped MCB interface, no other interface can use memory mapped into page D of the PC memory map. (See the accompanying *ORTEC MCB CONNECTIONS-32 Hardware Property Dialogs Manual*, P/N 931001, hereinafter called the *MCB Properties Manual*. It is supplied either as hardcopy or on disk.) Data can be saved or retrieved from any number of removable or fixed drives.

1.3. Detectors

Supported front-end acquisition hardware includes ORTEC MCBs interfaced to the computer via USB port, Ethernet, Dual-Port Memory (DPM) interface, serial port, or printer-port. An ORSIM™ II or III can also be used to connect DPM MCBs directly to the Ethernet.

ScintiVision can control and display an almost unlimited number of ORTEC CONNECTION 32 compatible Detectors, either local or networked, in any combination. The limit depends on system resources. ScintiVision will correctly display and store a mixture of different sizes of spectra. Multiple ScintiVision windows can be open at one time, displaying Detectors, buffers, spectrum files from disk, and data analyses. The larger and higher-resolution your monitor, the more windows you can comfortably view.

Expanding the system for more Detectors (as well as enabling more than one device on a Model 919) is easy. When the system incorporates a Model 920- or OCTÊTE® Plus-type MCB, the system can also be expanded using the internal multiplexer/router. In the Model 920 or OCTÊTE Plus, the MCB memory is divided into *segments* so that each input has an equal share of the MCB memory, the size of which matches the conversion gain or maximum channel number of the ADC. Note that in the multiple-input MCBs like the Model 919 or Model 920, all

inputs are treated as different Detectors. Therefore, all CONNECTIONS software will address one physical 919 unit as four distinct Detectors.

2. INSTALLING SCINTIVISION-32

If your ScintiVision-32 CD is accompanied by a CONNECTIONS-32 Driver Update Kit (P/N 797230), *follow the installation instructions that accompany the update kit, which supersede the instructions below, except the following note.*

NOTES If you are installing a new ORTEC MCB in addition to ScintiVision, the MCB is bundled with the latest version of our MAESTRO®-32 MCA Emulation Software, in addition to the CONNECTIONS-32 Driver Update Kit. If you will also be installing the new version of MAESTRO, ***be sure to install MAESTRO first, followed by ScintiVision***. Install the Driver Update Kit *last*.

Note also that CONNECTIONS-32 software products are designed to operate correctly only for users with full Administrator privileges. Limiting user privileges could cause unexpected results.

1. Insert the ScintiVision-32 CD. If it does not autorun, go to **My Computer**, navigate to the CD or DVD drive, and locate and open **`\Disk 1\Setup.exe`**. This will start the installation wizard.

2. On the Instrument Setup page, mark the checkbox(es) that corresponds to the instrument(s) installed on your PC, as shown in Fig. 1. To see more information on each instrument family, click on the family name and read the corresponding **Item Description** on the right side of the dialog.

   If you already have ORTEC CONNECTIONS-32 MCBs attached to your PC, they will be included on the **Local Instrument List** at the bottom of the dialog, along with any new instruments. Existing (previously configured before this upgrade) instruments do not have to be powered on during this part of the installation procedure.

   NOTE You can enable other device drivers later, as described in Section 2.2.

3. If you want other computers in a network to be able to use your MCBs, leave the **Allow other computers to use this computer's instruments** marked so the MCB Server program will be installed. Most users will leave this box marked for maximum flexibility.

   NOTE If your PC uses Windows XP and you wish to use or share ORTEC MCBs across a network, ***be sure to read Section 2.1***.

4. Click on **Done**.

5. At the end of the wizard, restart the PC. Upon restart, remove the ScintiVision CD from the drive.

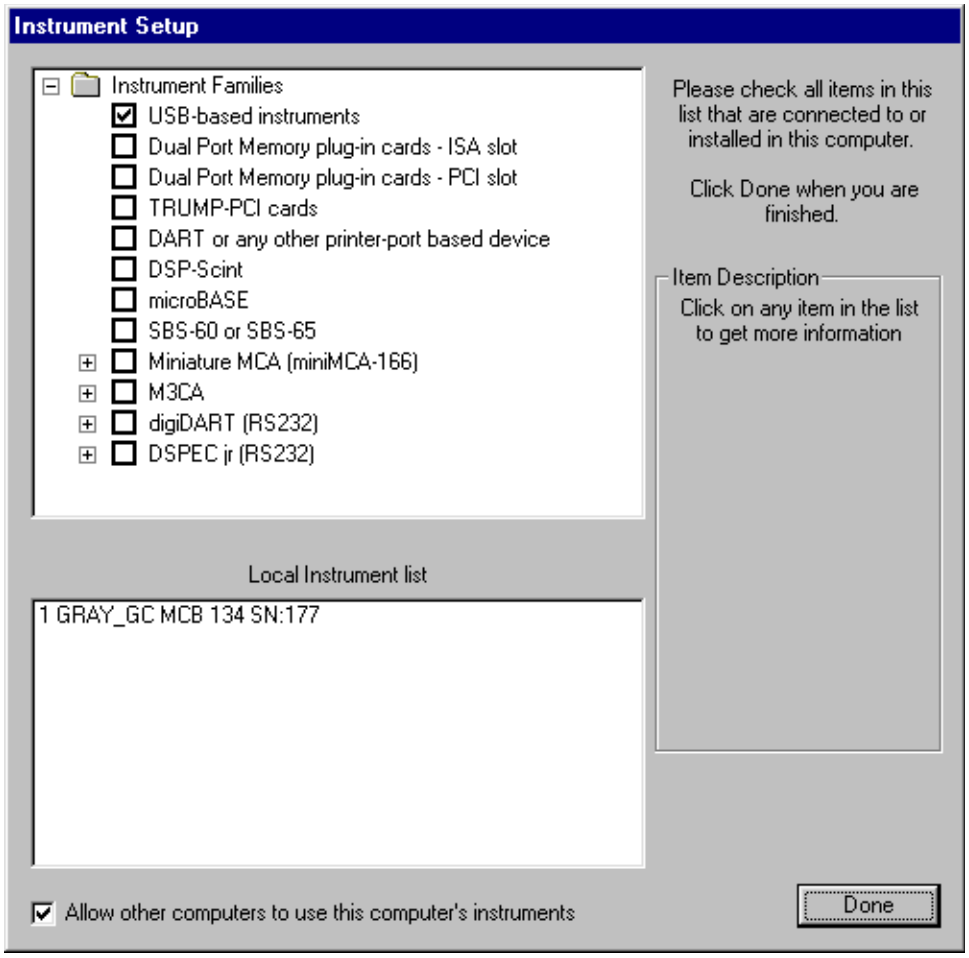

Instrument Setup
Instrument Families
USB-based instruments
Dual Port Memory plug-in cards - ISA slot
Dual Port Memory plug-in cards - PCI slot
TRUMP-PCI cards
DART or any other printer-port based device
DSP-Scint
microBASE
SBS-60 or SBS-65
Miniature MCA (miniMCA-166)
M3CA
digiDART (RS232)
DSPEC jr (RS232)
Please check all items in this list that are connected to or installed in this computer.
Click Done when you are finished.
Item Description
Click on any item in the list to get more information
Local Instrument list
1 GRAY_GC MCB 134 SN:177
Allow other computers to use this computer's instruments
Done

Fig. 1. Choose the Interface for Your Instruments.

6. After all processing for new plug-and-play devices has finished, you will be ready to configure the MCBs in your system. Connect and power on all local and network ORTEC instruments that you wish to use, as well as their associated PCs. Otherwise, the software will not detect them during installation. Any instruments not detected can be configured at a later time.

7. If any of the components on the network is a DSPEC® Plus, ORSIM II or III, MatchMaker, DSPEC®, 92X-II, 919E, 920E, 921E, Ethernet-connected OCTÊTE, or other module that uses an Ethernet connection, the network default protocol must be set to the **IPX/SPX Compatible Transport with NetBIOS** selection on all PCs that use CONNECTIONS hardware. For instructions on making this the default, see the network protocol setup discussion in the *MCB Properties Manual*.

8. To start the MCB Configuration program on your PC, go to the Windows **Start** menu and click on **ScintiVision 32**, and **MCB Configuration**. The MCB Configuration program will locate all of the (powered-on) ORTEC MCBs attached to the local PC and to (powered-on) network PCs, display the list of instruments found, allow you to enter customized instrument numbers and descriptions, and optionally write this configuration to those other network

PCs, as described in detail in the software installation chapter of the *MCB Properties Manual*. *If this is the first time you have installed ORTEC software on your system, be sure to refer to the MCB Properties Manual for information on initial system configuration and customization*.

ScintiVision-32 is now ready to use, and its MCB pick list can be tailored to a specific list of instruments (see Section 5.7.5).

2.1. If You Have Windows XP Service Pack 2 and Wish to Share Your Local ORTEC MCBs Across a Network

NOTE If you do not have instruments connected directly to your PC or do not wish to share your instruments, this section does not apply to you.

If you have installed Windows XP Service Pack 2 and have fully enabled the Windows Firewall, as recommended by Microsoft, the default firewall settings will prevent other computers from accessing the CONNECTIONS-32 MCBs connected directly to your PC. To share your locally connected ORTEC instruments across a network, you must enable **File and Printer Sharing** on the Windows Firewall Exceptions list. To do this:

1. From the Windows Control Panel, access the **Windows Firewall** entry. Depending on the appearance of your Control Panel, there are two ways to do this. Either open the **Windows Firewall** item (if displayed); or open the **Network Connections** item then choose **Change Windows Firewall Settings**, as illustrated in Fig. 2. This will open the Windows Firewall dialog.

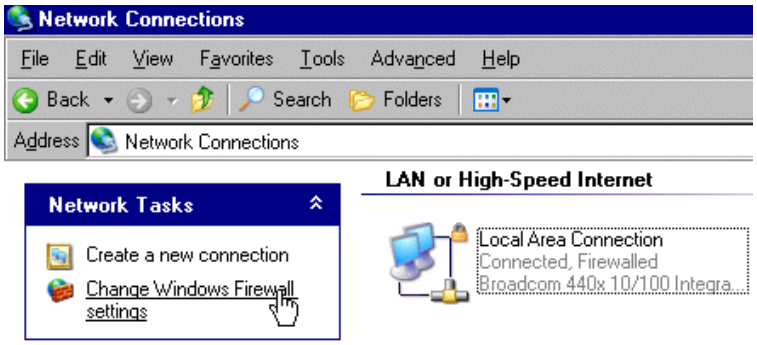


Fig. 2. Change the Firewall Settings.

2. Go to the Exceptions tab, then click to mark the **File and Printer Sharing** checkbox (Fig. 3).

   NOTE This affects only the ability of other users on your network to access your MCBs. You are *not required* to turn on **File and Printer Sharing** in order to access networked MCBs (as long as those PCs are configured to grant remote access).

3. To learn more about exceptions to the Windows Firewall, click on the **What are the risks of allowing exceptions** link at the bottom of the dialog.

4. Click on **OK** to close the dialog. No restart is required.

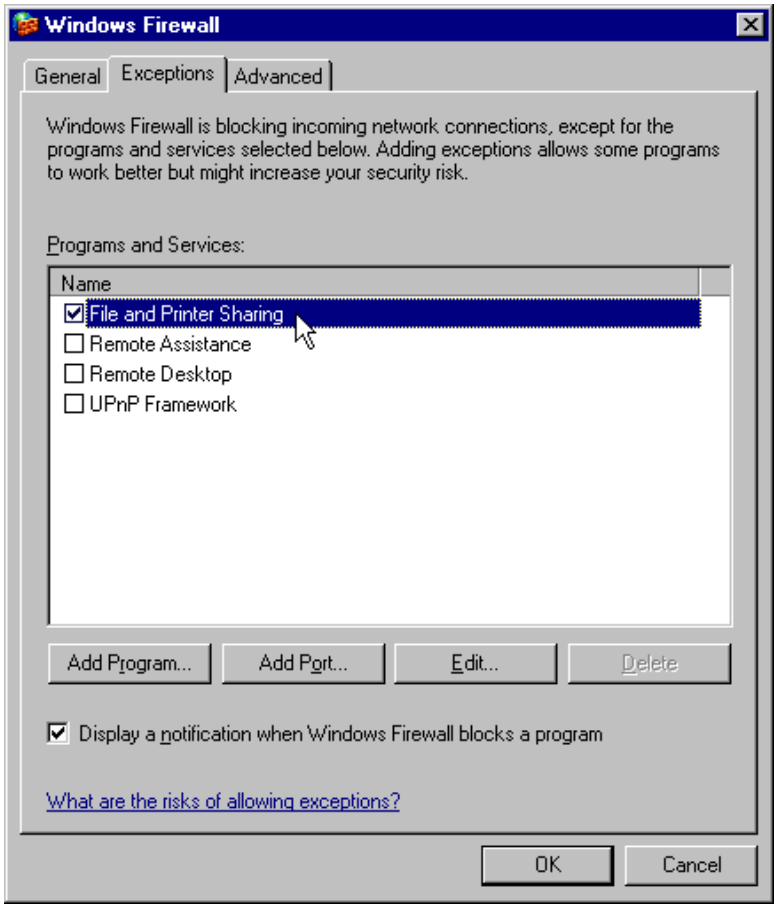


Fig. 3. Turn on File and Printer Sharing.

2.2. Enabling Additional ORTEC Device Drivers

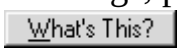
You can enable other device drivers later with the Windows **Add/Remove Programs** utility on the Control Panel. Select **Connections 32** from the program list, choose **Add/Remove**, then elect to **Modify** the software setup. This will reopen the Instrument Setup dialog so you can mark or unmark the driver checkboxes as needed, close the dialog, restart the PC when instructed, then re-run the MCB Configuration program as described in Step 8 on page 6.

3. GETTING STARTED TUTORIAL

3.1. Introduction

This chapter provides a series of straightforward examples to help you become familiar with ScintiVision's basic operations and move on quickly to full use. We will cover the following functions:

- Recalling a spectrum file from disk
- Performing a simple analysis of the spectrum
- Loading a nuclide library
- Using the library editor
- Energy calibration
- Efficiency calibration
- Getting a Detector ready for data acquisition

To display help for any of the dialogs, put the mouse pointer on the item and click the right mouse button to display the 

button. Now click the left mouse button to display the help message. After reading the help message, click the left mouse button to close the message box.

To make the discussion easier and more realistic, the sample files supplied on the ScintiVision CD-ROM will be used in the following examples. Use Windows Explorer to verify that the following files have been copied to your working directory, **`c:\User`**, during installation:

`SVDEMO1.SPC`	**`SVDEMO.EFT`**
`SVDEMO2.SPC`	**`SVDEMO.LIB`**
`SVDEMO.ENT`	

Before we actually begin, here is a short note on the *Detector and buffer concept* used in ScintiVision.

A spectrum can exist in three places in ScintiVision:

- In an MCB (which we call a Detector)
- In computer memory (a buffer)
- In a file on disk

The Detector is where the data are gathered from the HPGe detector. Data can be displayed and manipulated directly in the Detector memory or a buffer. They can be copied from the Detector to either the buffer or disk. Actions on the data in the buffer or spectrum file windows have no effect on data acquisition taking place in a Detector — ScintiVision maintains separate calibrations and viewing settings for each Detector, buffer, and spectrum file window.

3.2. Starting ScintiVision

To start ScintiVision, go to the Windows start menu and click on **ScintiVision 32**, **ScintiVision** (see Fig. 4). ScintiVision will check for Detectors, then display an opening screen similar to Fig. 5.

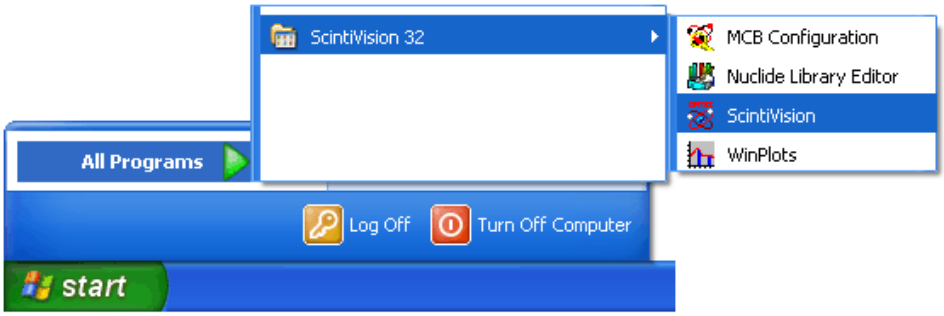


Fig. 4. Starting ScintiVision.

For illustrative purposes, this figure does not show an open spectrum window. However, ScintiVision will attempt to open the last Detector displayed in the previous work session. If it cannot find that Detector, no windows will open in the spectrum area.

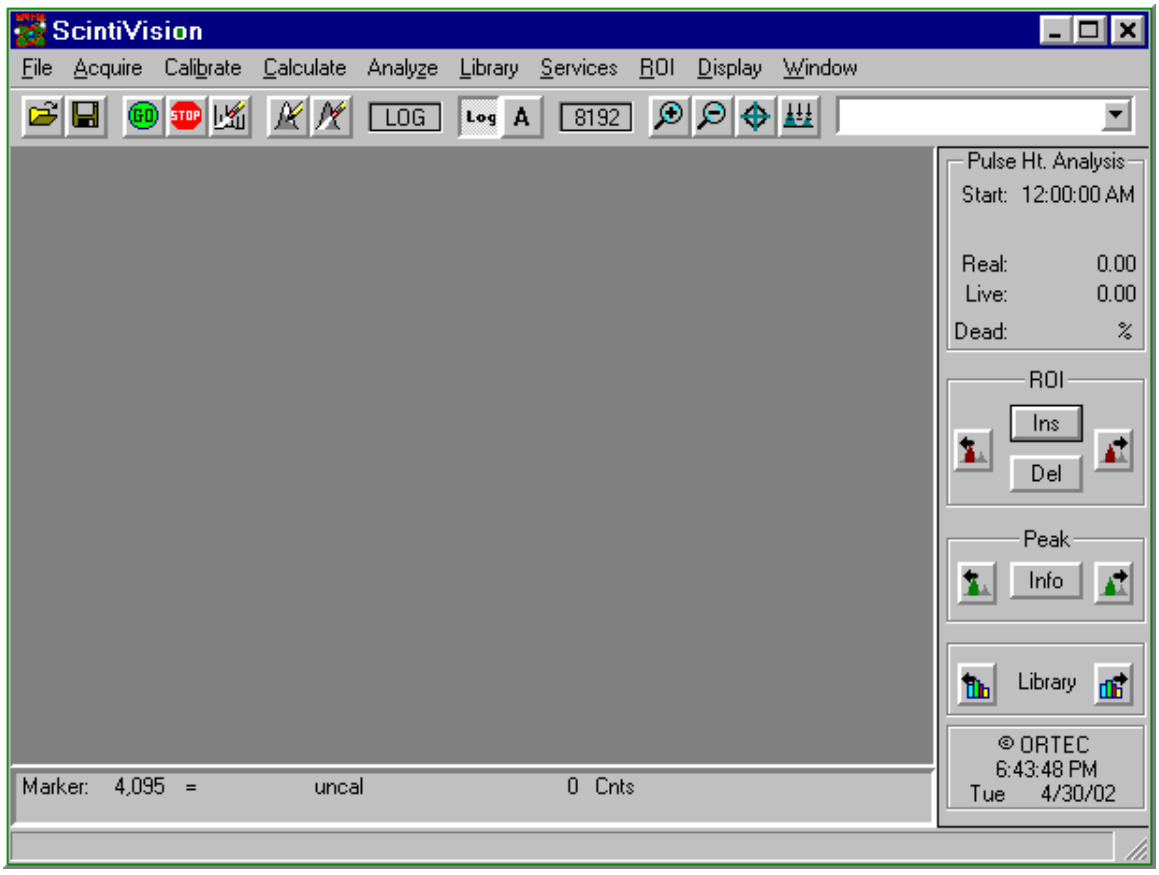


Fig. 5. The ScintiVision Opening Screen.

3.2.1. Recalling a Spectrum

Open **SVDEMO1.SPC** as follows: On the Menu Bar, click on **File**, then click on **Recall**. This will open a dialog showing the list of spectrum files in the current directory,[2] as shown in Fig. 6. From the list of files, double-click on **SVDEMO1.SPC**, or click once on the file name then click on **OK**. **SVDEMO1.SPC** will be displayed in a window as shown in Fig. 7. The *Status Sidebar* on the right of the screen will now show details about this spectrum. When a second spectrum is recalled, it will be displayed in a second window, and so on.

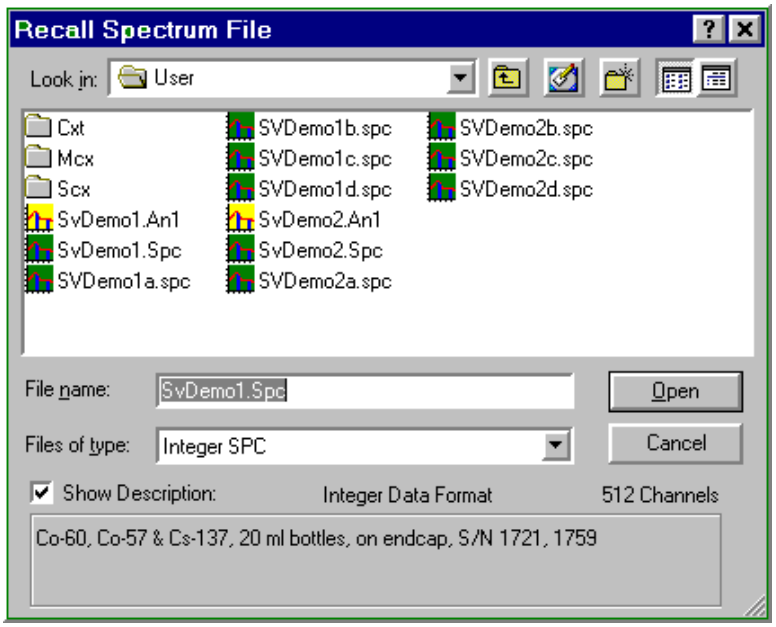


Fig. 6. Recalling a Spectrum File.

The sidebar will show details for the spectrum in the active window (click on a portion of an inactive window to activate it).

Note the vertical *marker* line, which you can move by clicking the left mouse button on a different part of the spectrum. The *Marker Information Line* at the bottom of the display reflects the channel contents at the marker's location. You can tell that this spectrum is already calibrated because the information about the marker reads in units of energy, keV. (An uncalibrated spectrum would instead display the word **uncal**.)

[2]If the spectrum files listed on page 11 are not present, the working directory is probably not set to **C:\User**. Click on the **Look in** droplist and select **C:\User** as your working directory.

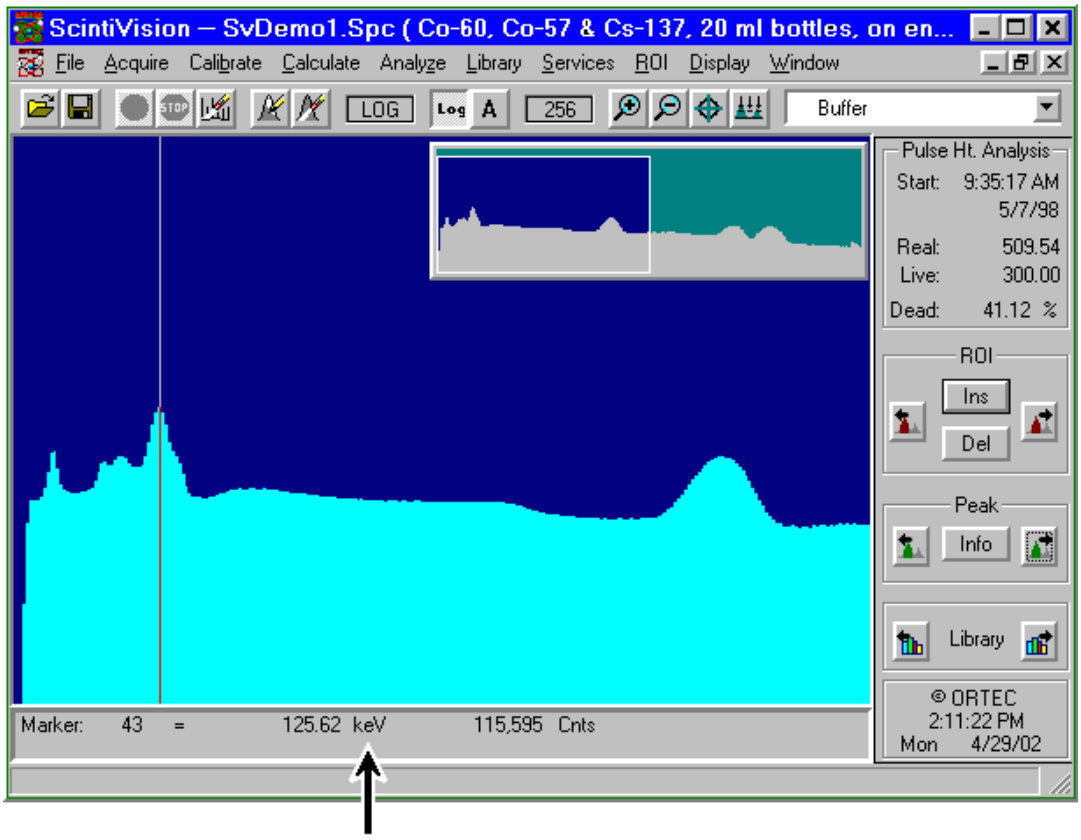


Fig. 7. Calibrated Spectrum Recalled from Disk File.

3.2.2. The Simplest Way To Do An Analysis

Select a portion of the **`SVDEMO1.SPC`** spectrum for analysis by positioning the mouse on or near the 1332-keV peak in the *Full Spectrum View* (Fig. 8), which will be located near the upper left edge of the window, and clicking the left mouse button. This will move the marker to the mouse pointer. The *Expanded Spectrum View* will now show this part of the spectrum.

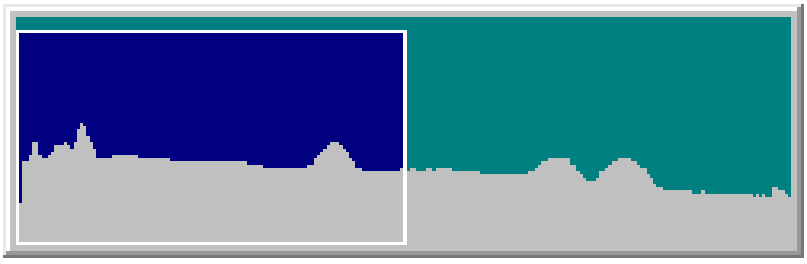


Fig. 8. Full Spectrum View.

Now zoom in on this part of the spectrum by going to the Toolbar and clicking on the **Zoom In** button ( ) five or six times. As you click, note that the Full Spectrum View will show the portion of the spectrum that you are zooming, and the Expanded Spectrum View will display this part of the spectrum (see Fig. 7). If the 1332-keV region is not on the screen, click on the peaks in the right side of the Full Spectrum View to reposition the zoomed region.

Once you have zoomed in on the 1332-keV peak, go to the Menu Bar and click on **Analyze**, then **Interactive in viewed area...** (see Fig. 9). ScintiVision will automatically analyze the selected region and display the results. The *Analysis Sidebar* will open (it is shown superimposed on the Status Sidebar in Fig. 10). The peak fit(s) will be shown graphically, and the numerical results will be displayed in an *Analysis Results Table* window, as shown in Fig. 10.

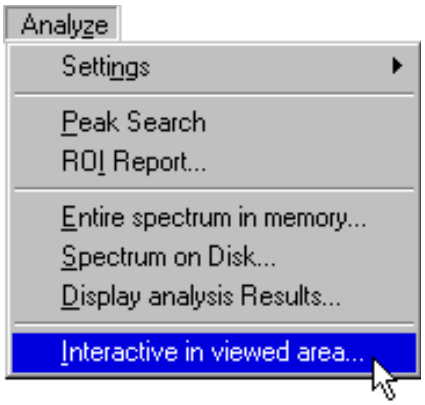


Fig. 9. Analyze/Interactive in Viewed Area.

That's all it takes to do an analysis!

There are several functions you can access at this point, but first we will load a *working nuclide library* and check some parameters. Exit this analysis session by clicking on the Analysis Sidebar's Close button ( ). This will close the Analysis Sidebar and the Analysis Results Table.

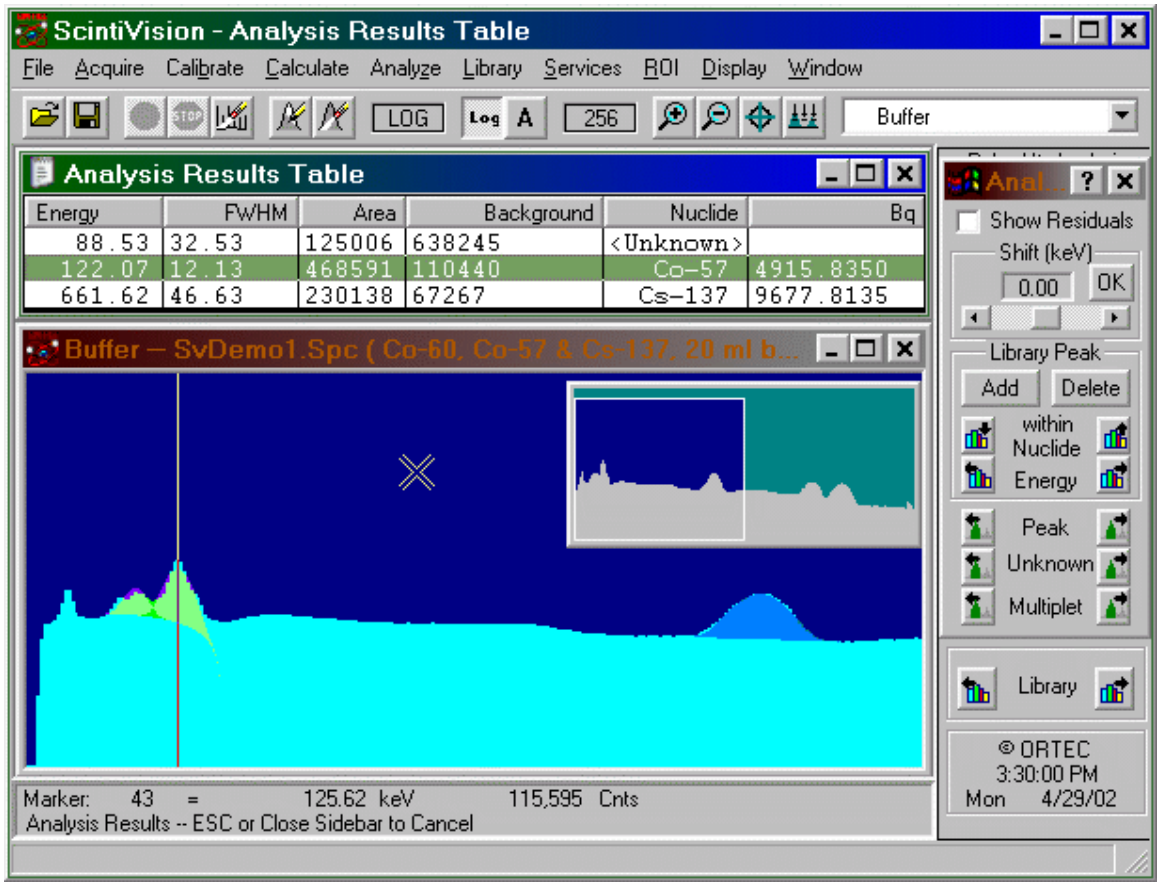


Fig. 10. Completed Analysis, Showing Results Table and Analysis Sidebar.

3.2.3. Loading a Library

From the Menu Bar, select **Library**, then **Select File...** as shown in Fig. 11. This will open a list of nuclide libraries in the current directory.

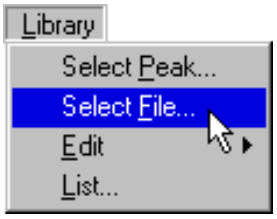


Fig. 11. Load a Library from Menu.

Select the library file **SVDEMO.LIB** and click on **OK** to load it. The following message will appear on the *Supplemental Information Line* at the bottom of the ScintiVision window:

```
SVdemo.lib: 3 Nuclides (13 alloc.); 5 Peaks (20 alloc.)
```

This message describes the library just loaded. **SVDEMO.LIB** contains 3 nuclides with space for 13, and has 5 peaks with space for 20.

This library, **SVDEMO.LIB**, is now loaded into the computer memory, and ScintiVision will use it for all analyses until you choose another library. Until you choose another, **SVDEMO.LIB** will automatically be reloaded each time ScintiVision is started.

3.2.4. Setting the Analysis Parameters

Click on **Analyze**, then **Settings**. From the submenu that opens (Fig. 12), select **Sample Type...**. This will open the **Analysis Options** dialog shown in Fig. 13. These sample type settings allow you to specify the various analysis parameters for analysis of the currently displayed spectrum. In routine use, these would not be changed, except for the **Sample Description**. The entry of **Sample Weight** and **Sample Description** can be automated using the **Acquisition Settings...** command under the **Acquire** menu.

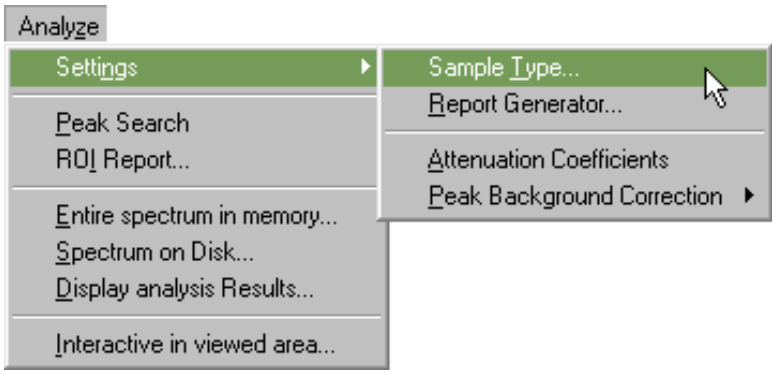


Fig. 12. Selecting the Sample Type... Command.

The **Nuclide Library** is the one just loaded in computer memory. The **Calibration** is the calibration in computer memory, in this case, the calibration that was stored in **SvDemo1.Spc** and recalled along with the spectrum.

Select the **Report** tab to view the output options (Fig. 14).

To send the output to a printer (as well as a file), go to the **Output** section of the screen and click on the **Printer** radio button to mark it with a dot.

To send the output to a file only, click on the **File** radio button, and leave the asterisk (*****) as the filename.

To send the output to a text processing program, such as Windows Notepad (which is the default), click on the **Program** radio button.

Click on all four checkboxes in the **Reporting Options** section of the screen, then click on **OK**. Select **Analyze** and **Entire spectrum in memory...** to start the analysis. Once the "hourglass" has disappeared from the screen, you can continue with other system operations while the analysis runs to completion. The computer will beep when the analysis is complete. Spectra can be analyzed in a buffer (as we have done here), directly from disk, or in the Detector memory (when the Detector is not counting). If more than one window is open at one time, *the spectrum in the active window will be the one analyzed*.

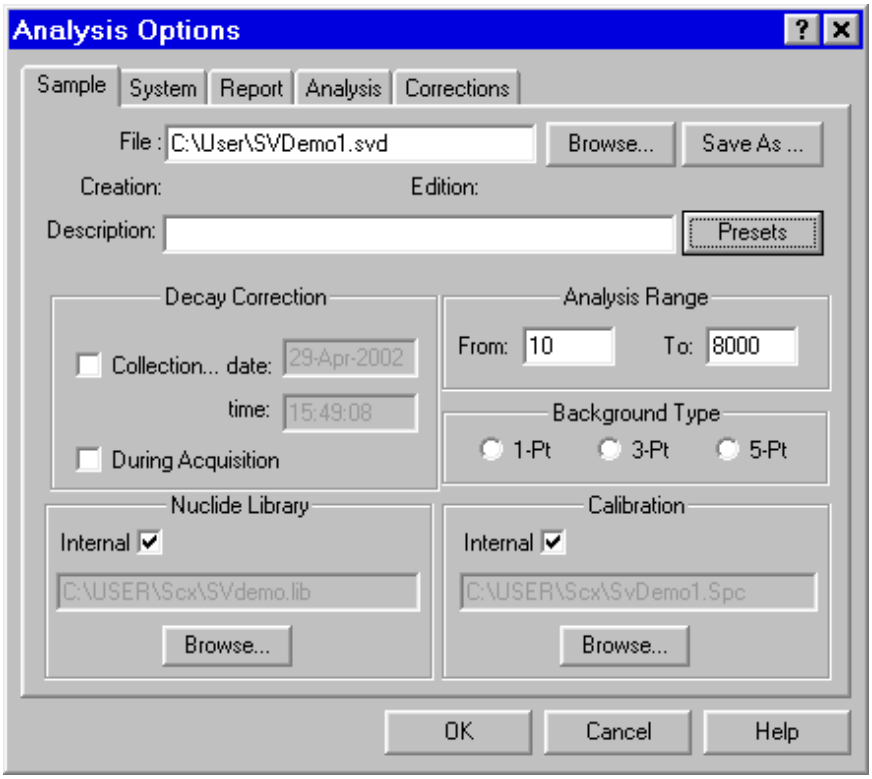


Fig. 13. Analysis Options Dialog, Sample Tab.

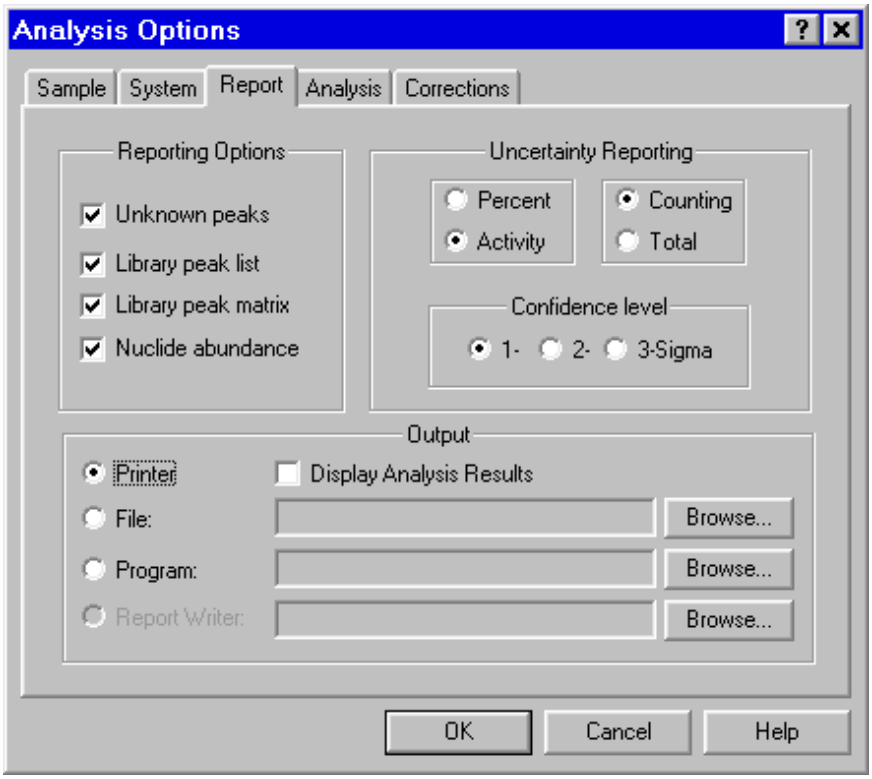


Fig. 14. Analysis Options Dialog, Report Tab.

While the analysis is taking place, put the marker on the peak at 136 keV and expand the display horizontally with **Zoom In**.

After the analysis is complete, the results will be printed or saved to disk (according to your selection on the **Report** tab on the **Analysis Options** dialog). They can also be graphically displayed by selecting **Analyze** and **Display Analysis Results...**, then clicking on **Open** to load the analysis results file, **`SVDEMO.UFO`**. This will overlay the peak shapes on the spectrum data, open the Analysis Results Table for the spectrum, and display the Analysis Sidebar superimposed over the Status Sidebar, as shown in Fig. 15. Zoom in to see more details.

Put the mouse on the ^{137}Cs (661.6 keV) entry in the peak list table and click. The marker will move to that peak in the display. You can use the scroll bars on the peak list window to show other energies, and then when you click on the energy, the display will show that peak.

In this mode, you can also use the buttons on the Analysis Sidebar to move the marker in the spectrum. For example, click on ^{137}Cs in the peak table, then click on Energy (the right-hand **Energy** button in the **Library Peak** section of the Analysis Sidebar) to put the marker on the next-highest-energy library peak, which is the 1173.2-keV line of ^{60}Co. Note that this peak is now highlighted in the Analysis Results Table.

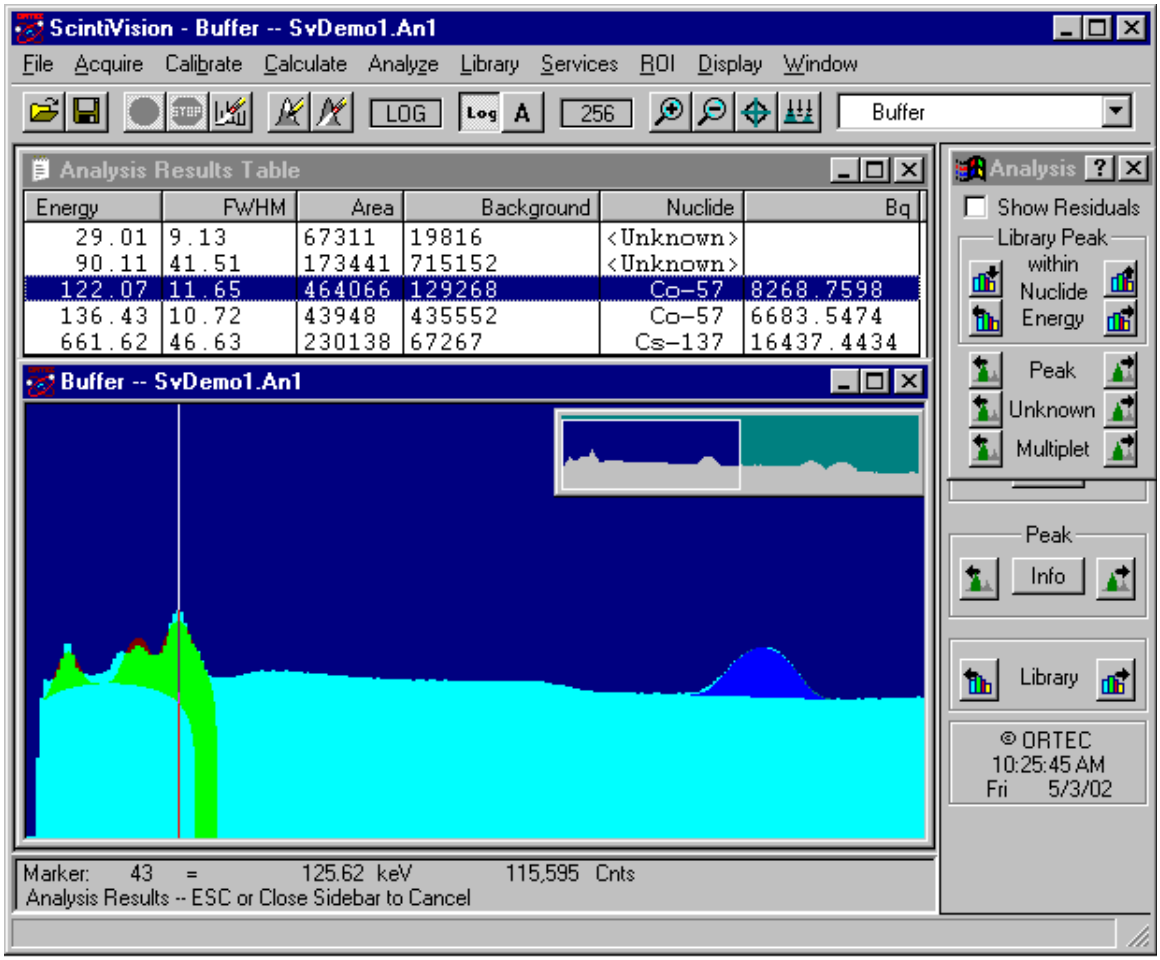


Fig. 15. Display Analysis Results.

Now click on within Nuclide to go to the next-highest-energy peak in the library for ^{60}Co. The **within Nuclide** buttons are useful for checking if other peaks for the nuclide exist so that you can confirm their identity. The within Nuclide button moves the marker in reverse order through the peaks for the selected nuclide.

The Unknown buttons are used to select the spectrum peaks that are not associated with a library energy. This is useful to see if there are any unidentified spectrum peaks that should be considered in the complete analysis.

The Multiplet buttons are used to select the regions with overlapping peaks. With these, you can easily check how the analysis of complicated regions was handled.

Now, select **Library** and **Select Peak...** to show a list of the peaks in the current library.[3] You can use this list of peaks to move around in the spectrum. Click on the Library List window's

[3]This may be a different library than the one used in the analysis of the spectrum.

down arrow to scroll down to 122-keV ^{57}Co. Now click on this entry and the display will update to this peak.

Exit this analysis session by clicking on the Analysis Sidebar's Close button ( ). This will close the Analysis Sidebar and the Analysis Results List window. Leave the Library List window open.

3.2.5. Energy Calibration

For this example, we will use the spectrum files supplied with ScintiVision to recalibrate the buffer. The same procedure is used to calibrate the Detector spectrum.

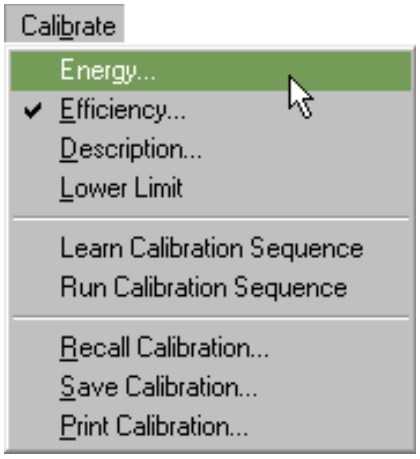


Fig. 16. Start Energy Calibration from Menu.

The display should be showing the **SVDEMO1.SPC** spectrum window and Library List window. If the complete library peak list is not visible, you can click and drag the window edges to resize it.

From the **Calibrate** menu (Fig. 16), select **Energy...**. The *Energy Calibration Sidebar* (Fig. 17), will open superimposed on the Status Sidebar. Note that you can move this sidebar by clicking and dragging the"**Calibr...**" title bar. (You can also move the other windows the same way.)

This time, so that we're starting from the very beginning, we will destroy the current energy calibration by clicking on the icon to the left of the title "**Calib...**". This will open the *control menu* shown in Fig. 18. Click on **Destroy**. The Marker Information Line now shows the legend **uncal**.

Fig. 17. Energy Calibration Sidebar.

Move the cursor to channel 401, the location of the upper ^{60}Co peak, at 1332.5 keV. Do this directly in the Full Spectrum View or by using the Peak buttons until you get there. Click once in the **E=** field at the top of the Calibration Sidebar, enter the correct energy for this peak (1332.5 keV), mark an ROI, and click on **Enter**. The system will automatically perform a simple calibration based on this peak and the assumption that channel zero is energy zero. The graphs of the calibration and the table of values will be displayed, as shown in Fig. 19.

If the screen becomes too visually crowded, you can move one or more windows until they are nearly "stacked" atop each other (leave at least an edge or corner of each window showing); or close one or more windows by clicking on their Close box ( ). However, *do not close the Calibration*

Sidebar or you'll end the calibration session. Remember, you can bring a window to the front by clicking on any part of it (if it's not visible, move one or more of the others until you can see it).

Now we can use the library. Double-click on the 661.62-keV peak of ^{137}Cs in the library list. The marker will move close to, but not precisely on, that peak in the spectrum, based on our current "one-point calibration." Use the Peak buttons to put the cursor on the peak, then click once on the 661.62-keV entry in the library list. Note that the **E= 661.62 keV** in the Calibration Sidebar already has the appropriate energy from the library, and you need only accept it by marking an ROI and clicking on **Enter**. The re-fitted calibration curve is automatically displayed.

Fig. 18. Energy Calibration Sidebar Control Menu.

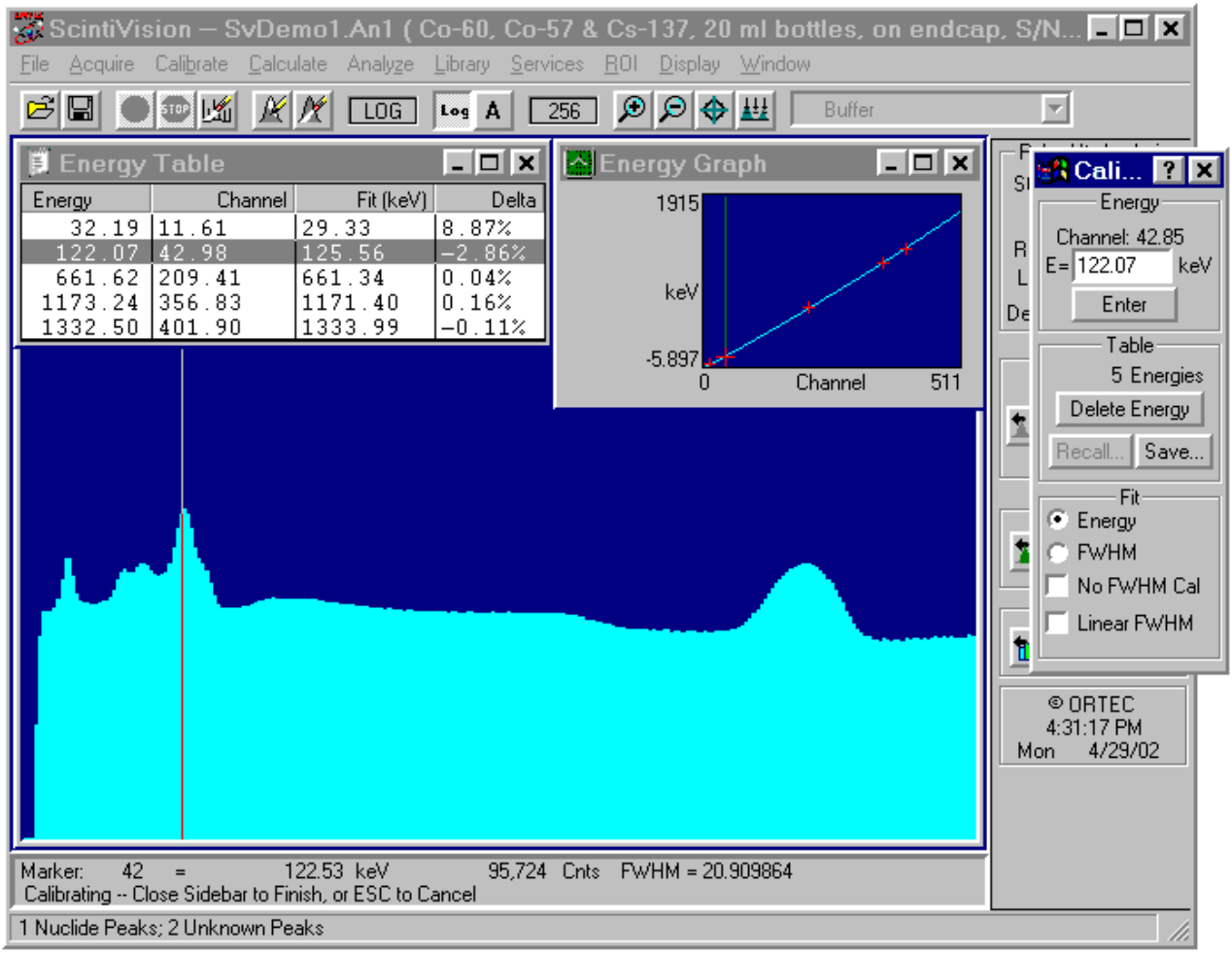


Fig. 19. Energy Calibration Display.

Proceed through the library list (see Table 1), adding the following peaks (in any order) into the calibration. To do this, double-click on the peak energy in the library list, look at the display to see that the cursor is on the peak, then click on **Enter**.

If you decide that you don't want one of the peaks, just delete it by clicking on the **Delete Energy** button on the Calibration Sidebar.

Now bring the **Energy Table** window to the front, and note that the **Delta**s (the differences between data points and the fit to the data points) are small. Next, bring the **Energy** plot window to the front and examine the calibration curve visually. You can, of course, increase the size of these windows to allow a closer examination of the graphical fit.

Table 1. Source Energies.

Nuclide	Energy (keV)
^{88}Y	1836.01
^{57}Co	122.07
^{60}Co	1173.2
^{60}Co	1332.51
^{88}Y	898.02
^{137}Cs	661.66
^{113}Sn	391.69
^{203}Hg	279.17
^{109}Cd	88.03
^{241}Am	59.54

Click on the **FWHM** (full width at half maximum) radio button on the lower section of the Calibration Sidebar. This will change the table and calibration windows so they now display the table of FWHM results and the FWHM graph, as in Fig. 20. The FWHM fit uses the peaks specified in the energy fit. If FWHM of any peak has a deviation of more than 25% between the actual and fitted values, a warning message is displayed.

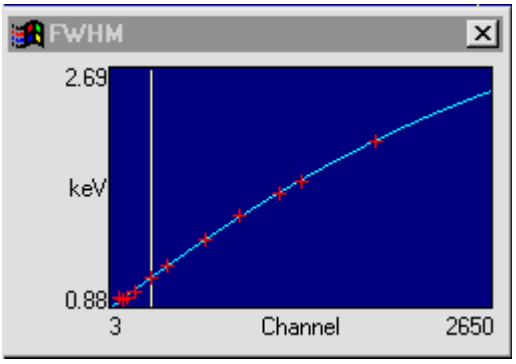


Fig. 20. FWHM Fit Selection.

Save the energy table for later use: click on the Calibration Sidebar's **Save** button, enter a name such as **SVDEMO** for the table filename, and click on **Save**. ScintiVision will append the correct extension, **.ENT**, to the filename. To examine the Energy Table, open the Calibration Sidebar's control menu and select **Edit File**. This table is simply a list of the energies of the peaks used for the calibration.

The energy calibration is complete; we shall consider this to be a "good" energy calibration for the purposes of this demonstration. Close the calibration session by opening the control menu in the calibration window and selecting **Close**.

This new energy calibration is now held in memory but is not yet stored on disk.

3.2.6. Efficiency Calibration

Select **Calibrate** from the Menu Bar, then **Efficiency**. This opens the *Efficiency Calibration Sidebar*, shown in Fig. 21 (note its similarity to the Energy Calibration Sidebar).

Fig. 21. Efficiency Calibration Sidebar.

We want to start from the beginning of the process, so open the sidebar's control menu and click on **Destroy**.

The Library List window should be visible, but if not, click on **Library/ Select Peak...** to reopen it.

From the library, double-click on the 1332.5-keV peak of ^{60}Co. When you double-click, the marker will move to the corresponding peak and ScintiVision will enter the energy in the top section of the Calibration Sidebar.

In the upper section of the sidebar, click on the **Calc...** button to open the Efficiency Calculation Worksheet (Fig. 22).

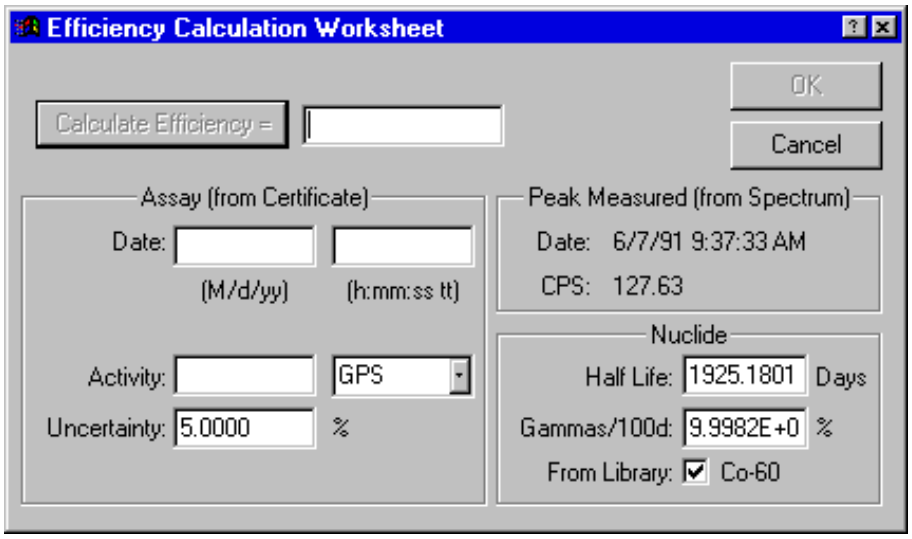


Fig. 22. Efficiency Worksheet.

Enter the date and the time from the calibration certificate (see Table 2), as 30-Oct-92 and 12:00:00. Enter the gammas per second (19671) from the calibration certificate for ^{60}Co at 1332.5 keV. Select **GPS** from the units drop-list. Note that the **from Library** box is checked; this shows that the half-life came from the library.

Table 2. List of Peak Energies.

Reference time 12:00 GMT 30 Oct 1992

Nuclide	Energy (keV)	Gammas/sec
^{57}Co	122.1	15920
^{137}Cs	661.63	15598
^{60}Co	1173.2	19640
^{60}Co	1332.5	19671

At this point, the **Calculate Efficiency=** button at the top of the worksheet should be active (black rather than gray). If it is gray, one or more of the data inputs is either incorrect or has not been entered. When you have completed all fields and **Calculate Efficiency=** is activated, click on it to obtain the efficiency value at this energy. Click on **OK** to insert the value in the efficiency table. You will see that the value appears in the Efficiency Table window.

You could repeat this process for all other peaks in the calibration certificate data, but there is an easier way. All of the information from the calibration certificate can be stored in an efficiency calibration (**`.EFT`**) file (see "Editing the Efficiency Calibration Table" on page 104 for instructions on creating and editing this file). Using this file to direct the calibration is easy. On the Efficiency Calibration Sidebar, just click on the **Recall...** button, then select the file **`SVDEMO.EFT`**. ScintiVision will use the data in the table to calculate the efficiency at each energy from the spectrum and fill in the efficiency table. You can see the marker jump from peak to peak in the spectrum as the peak areas are calculated.

When the data points are all calculated, the fit **Mode** stored in the file is used to make the fit. You can select another fit **Mode** from the Calibration Sidebar. In the list, choose the **Polynomial** option. This will automatically produce a quadratic fit of the entire energy range, as shown in Fig. 23.

The fit will take place automatically. You can then view it by bringing the **Efficiency** calibration fit window forward. Click on the window's control menu to choose scaling and grid display options (see Fig. 24). The marker line in the efficiency graph window will be at the energy of the peak selected in the Library List or the Efficiency Table window.

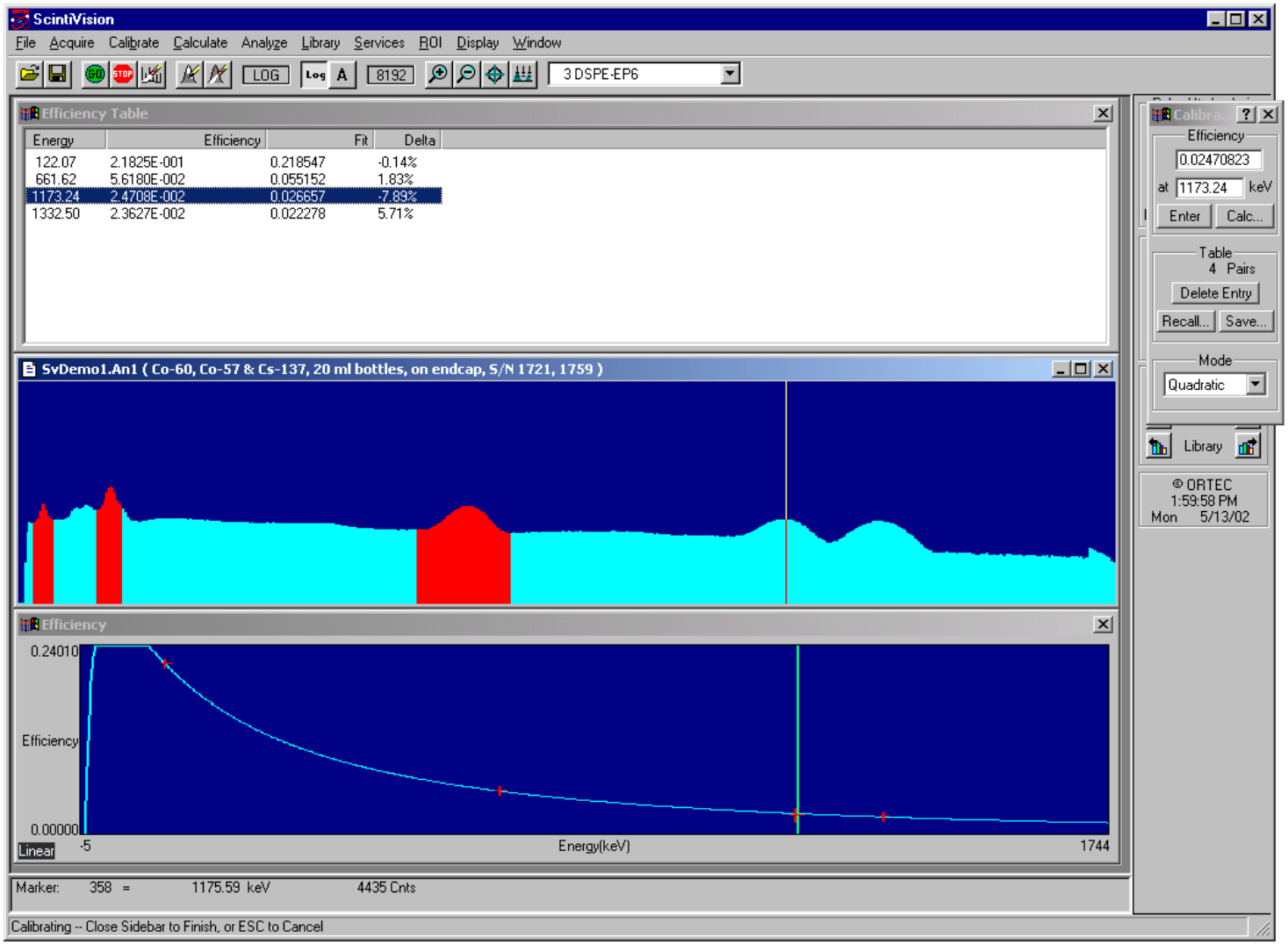


Fig. 23. Polynomial Efficiency Fit.

We will accept this calibration and close the calibration session by clicking on the Calibration Sidebar's **Close** button. Now save this calibration to disk by selecting **Calibrate** and **Save Calibration...**. Give the calibration file the name **SVDEMO**. ScintiVision will attach the default **.CLS** extension to the filename.

Fig. 24. Efficiency Fit Window Control Menu.

3.2.7. Changing a Library

Select **Library/Edit/ScintiVision Editor...** from the Menu Bar. This will open the **Editing** dialog (Fig. 25), which allows you to change, add, or delete nuclide and gamma-ray values in the currently loaded nuclide library file.

Select the nuclide ^{60}Co from the left-hand section of the dialog. All the gamma-ray energies or peaks for this nuclide will then appear in the **Peaks** section; select the

1332.5-keV peak. Click on **Edit...** in the **Peaks** section. This will open the **Edit Library Peak** dialog (Fig. 26), which will show the current values and allow you to change the energy and gammas-per-disintegration of the 1332.5-keV line.

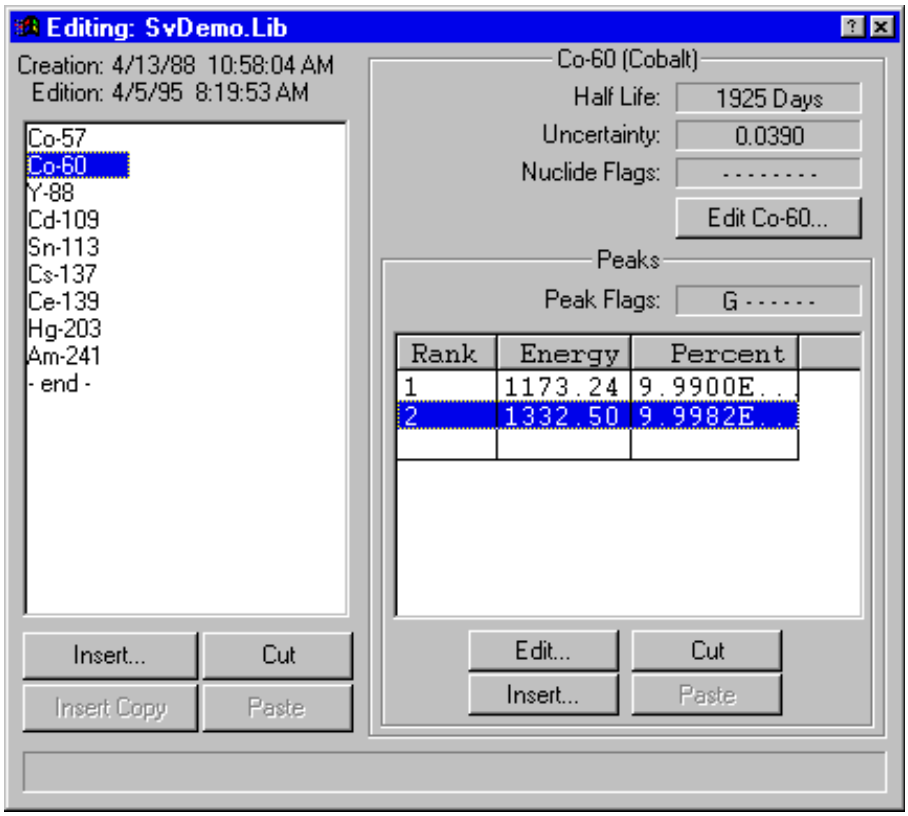


Fig. 25. Edit Nuclide Library with ScintiVision Editor.

Click on the **Gammas per 100 disintegrations** field and change the value, then click on **OK**. You will see that the **Gammas per 100 Disintegrations** value for this peak has been changed to the number you just entered.

Now click on the Editing dialog's **Close** button to leave the library editor. When asked if you want to save the modified library, click on **No** to ignore the change you just made in the **Gammas per 100 Disintegrations** field.

The ScintiVision library editor is explained in detail in Section 5.6. Note that ScintiVision can also use NuclideNavigator III libraries *as master libraries*

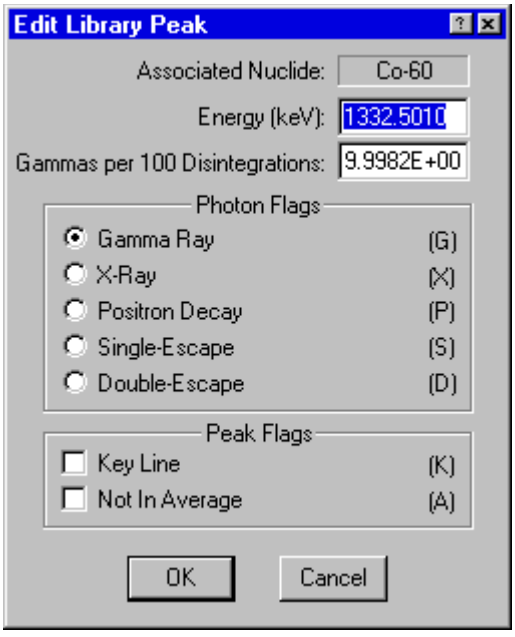


Fig. 26. Edit Nuclide Peak.

(not analysis libraries), and that you can access NuclideNavigator III directly from the ScintiVision **Library/Edit** submenu if the NuclideNavigator package is installed on your PC.

3.2.8. Detector Setup

Before starting data collection, make sure the detector, analog electronics (in older systems), and MCB are connected and powered on according to their respective hardware manuals.

The ScintiVision installation program will have already located the Detectors available to this PC. Click on the Detector pick list on the right of the Toolbar and select a Detector. The spectrum displays will update to show the data in this Detector.

In the simplest mode of operation, data acquisition is started from the Toolbar; simply click on the **Start** button. You can use the **Acquire** menu (Fig. 27) to check the analysis settings while data is being gathered. After acquisition stops, the analysis can proceed.

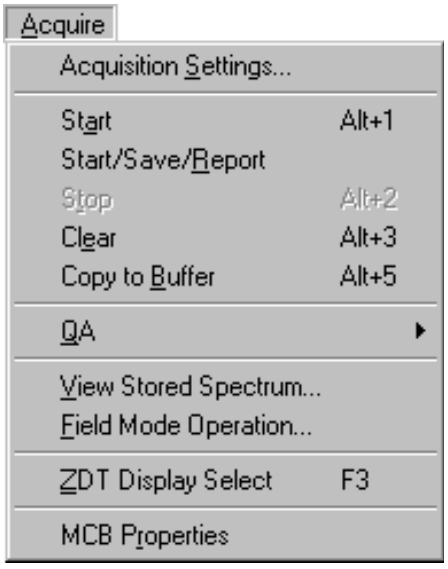


Fig. 27. Acquire Menu.

All of ScintiVision's hardware setup controls are now in *one, MCB-specific dialog*. Depending on your Detector, this might include controls for conversion gain, amplifier, high voltage, shaping, data acquisition presets, and more. To access this dialog, click on **Acquire/MCB Properties...**, or right-click the mouse to open its menu and select **MCB Properties**.

Some of the Detector's internal parameters can only be changed when the Detector is not acquiring data. To see if the Detector is in acquisition mode, open the **Acquire** menu look at the menu items. If **Stop** is black and **Start** is gray (note that Fig. 27 shows the opposite case), the Detector is in acquisition mode.[4] If this is the case, select **Stop** from the menu or Toolbar.

[4]We say "acquiring data" when the MCB is in acquisition mode, even if there are no counts accumulating in the MCB.

3.2.8.1. Conversion Gain

If you wish to change the conversion gain, click on **Acquire/MCB Properties...**, select the ADC tab (Fig. 28), then change the **Conversion Gain** field. The ADC gain is stored in the MCB and automatically recalled from the MCB the next time you restart ScintiVision. Note that in this example, we are using a 92X-II, and that the Properties dialog automatically displays only data fields that are applicable to this MCB.

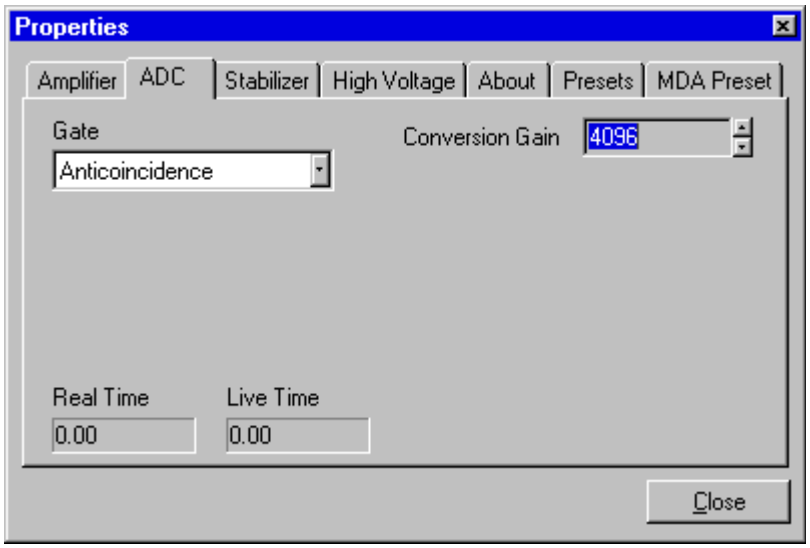


Fig. 28. Setting the 92X-II Conversion Gain.

If you have computer-controlled hardware, skip to Section 3.2.8.3.

3.2.8.2. Detectors Set Up Manually

Manually adjust the spectroscopy amplifier gain, shaping time, and pole zero according to the instructions in the amplifier manual. Most commonly, a range of 0–3 MeV is used. If you have a ^{60}Co source, the 1332-keV peak should be set at approximately channel 1816 for conversion gain of 4096 and channel 3632 for 8192. A source with only one or two lines (e.g., ^{137}Cs or ^{60}Co) should be used for the initial test spectrum so you'll be able to easily see the correct pattern of the peaks.

3.2.8.3. Computer-Controlled Hardware Setup

In this section, we will use ScintiVision to enable the 92X-II's high voltage and adjust the spectroscopy amplifier gain, shaping time, and pole zero.

Select **Acquire/MCB Properties...** to open the Properties dialog for this MCB, and click on the High Voltage tab (see Fig. 29).

Adjust the bias setting to the correct voltage on the rear panel of the 92X-II. Notice, as you adjust the voltage, that

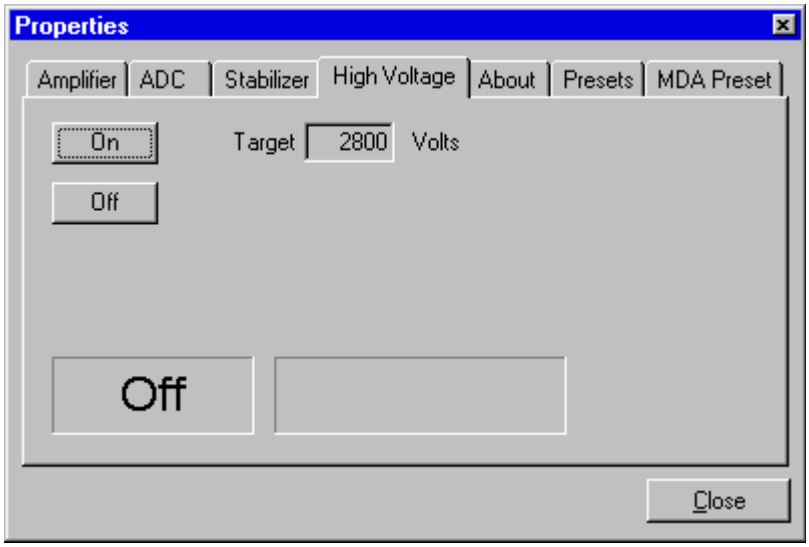


Fig. 29. Monitoring the 92X-II Bias Setting on the High Voltage Tab.

the value showing in the **Target** field on the High Voltage tab changes. The display setting is accurate to ±100 V.

When the value of the detector bias matches that shown on the detector's Quality Assurance data sheet (also given on the endcap label), click the **On** button to enable the bias. The HV On light on the 92X-II will illuminate. If it does not, either the HV shutdown is not connected or the detector is warm. (The detector might require 3–6 hours after filling before it is cold enough to take bias.)

3.2.8.4. Amplifier Settings

Click on the Amplifier tab (Fig. 30). The amplifier shaping time can be set to either **Long** or **Short**. The **Long** shaping time is the recommended choice for low to moderate count rates. The value of the shaping time (in μs) is given in the hardware manual.

If you have a transistor-reset pre-amplifier (Plus Series), select it from the **Preamplifier Type** droplist. Skip the following subsection on pole-zeroing and go to the discussion on adjusting amplifier gain.

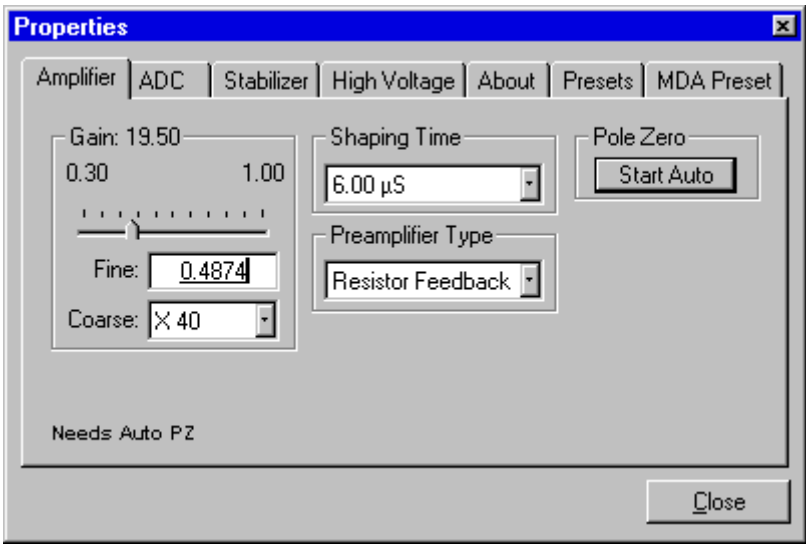


Fig. 30. The 92X-II Amplifier Tab.

Click on **Close** to apply the new MCB hardware settings.

Automatic Pole Zero[5]

Select **Acquire**, then **Start**, to start the Detector counting. Next, place a source such as ^{60}Co, of sufficient strength to produce a few percent dead time, in the Detector. During data collection, the dead time is shown on the center right of the display, as in Fig. 31.

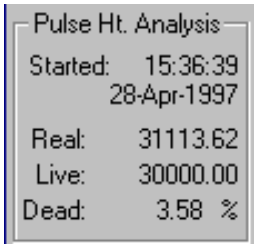


Fig. 31. Dead Time.

Next, return to **Acquire/MCB Properties...** and click on the Amplifier tab. Go to the **Pole Zero** section of the dialog and click on **Start Auto**. This will tell the Detector to automatically adjust the pole zero of the amplifier. While the pole-zero adjustment is in progress, you will hear a periodic beep and see the message "**Auto PZ in progress....**" The time needed for the pole zero depends on the activity

[5]U.S. Patents 4,866,400 and 5,872,363.

of the source and how far the pole zero is out of adjustment. No more than a minute or two should be required. Remember that if you change the shaping time, you must pole zero the Detector again.

Click on **Close** to apply the new MCB hardware settings.

Adjusting Amplifier Gain

Now adjust the amplifier gain to achieve the desired energy range across the Detector display. Most commonly, a range of 0–3 MeV is used. If you have a ^{60}Co source, the 1332-keV peak should be set at approximately channel 1816 for conversion gain of 4096, and channel 3632 ofor 8192 (see Fig. 32). A source with only one or two lines (e.g., ^{137}Cs or ^{60}Co) should be used for the initial test spectrum so you'll be able to easily see the correct pattern of the peaks. To set the gain for the 92X-II (as well as the DSPEC Plus, DSPEC, 92X, DART, and NOMAD Plus):

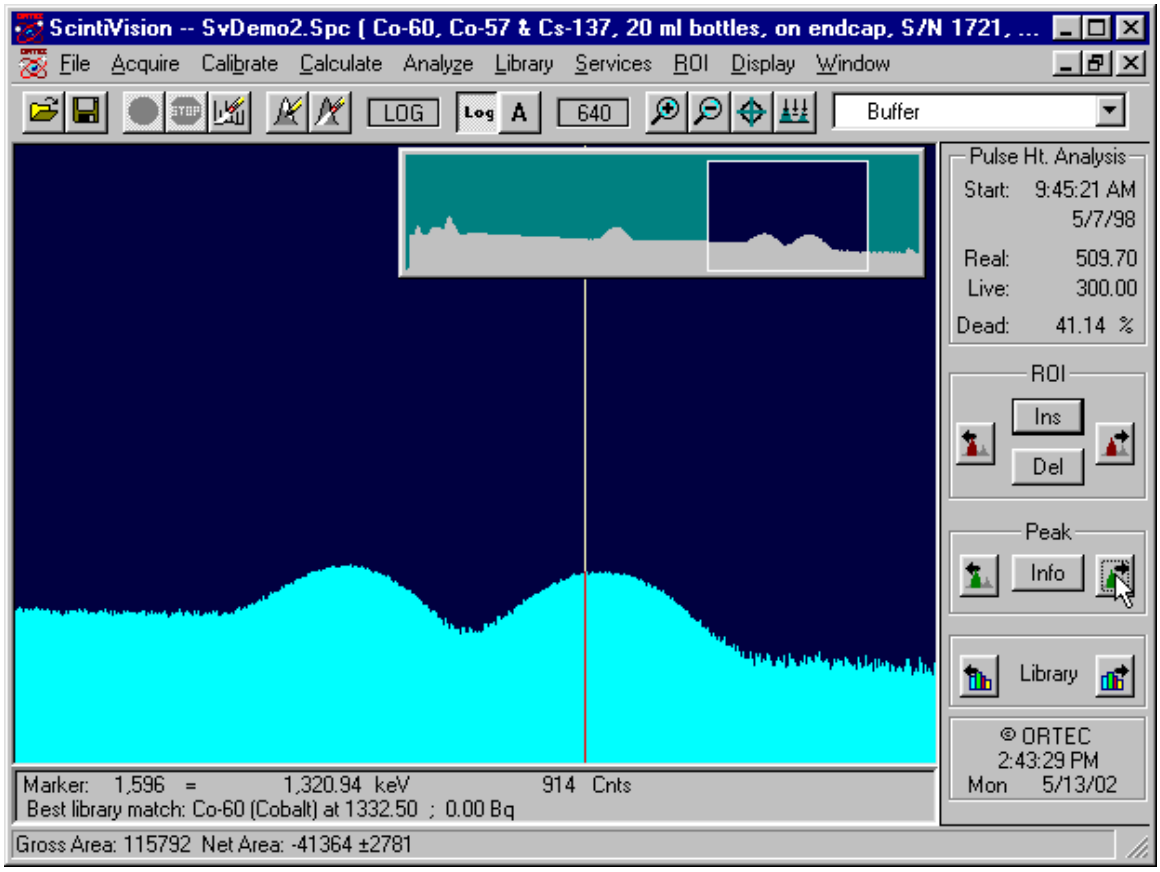


Fig. 32. Spectrum with ^{60}Co.

1. Start data collection by clicking on the **Start** Toolbar button or by selecting **Acquire/Start** from the Menu Bar.

2. Select **Acquire/MCB Properties...** and click on the Amplifier tab (Fig. 30).

3. Select the **Coarse Gain** setting from the droplist, then move the slider to the fine gain desired. The spectrum display is not continuously updated while the Properties dialog is open, but you can force an immediate spectrum update by moving the control dialog over the spectrum window, releasing it, then moving it away so the spectrum will redraw.

4. Once the gain is *approximately* correct, click on **Close** to close the control dialog, then use **<Alt + +>** and **<Alt + −>** to make fine gain adjustments until the peak is in the desired channel. To make coarser gain adjustments, use **<Alt + Shift + +>** and **<Alt + Shift + −>**. (These keyboard commands are discussed in Chapter 9.)

ScintiVision will retain all of these settings and adjustments on exit, and will reload them from the MCB on restart. You are now ready to acquire spectral data, calibrate, and analyze your own sample data.

4. DISPLAY FEATURES

This chapter addresses ScintiVision's display features, discusses the role of the mouse and keyboard, covers the use of the Toolbar and sidebars, and shows how to change to different disk drives and folders.

Figure 33 shows ScintiVision's principal screen features.

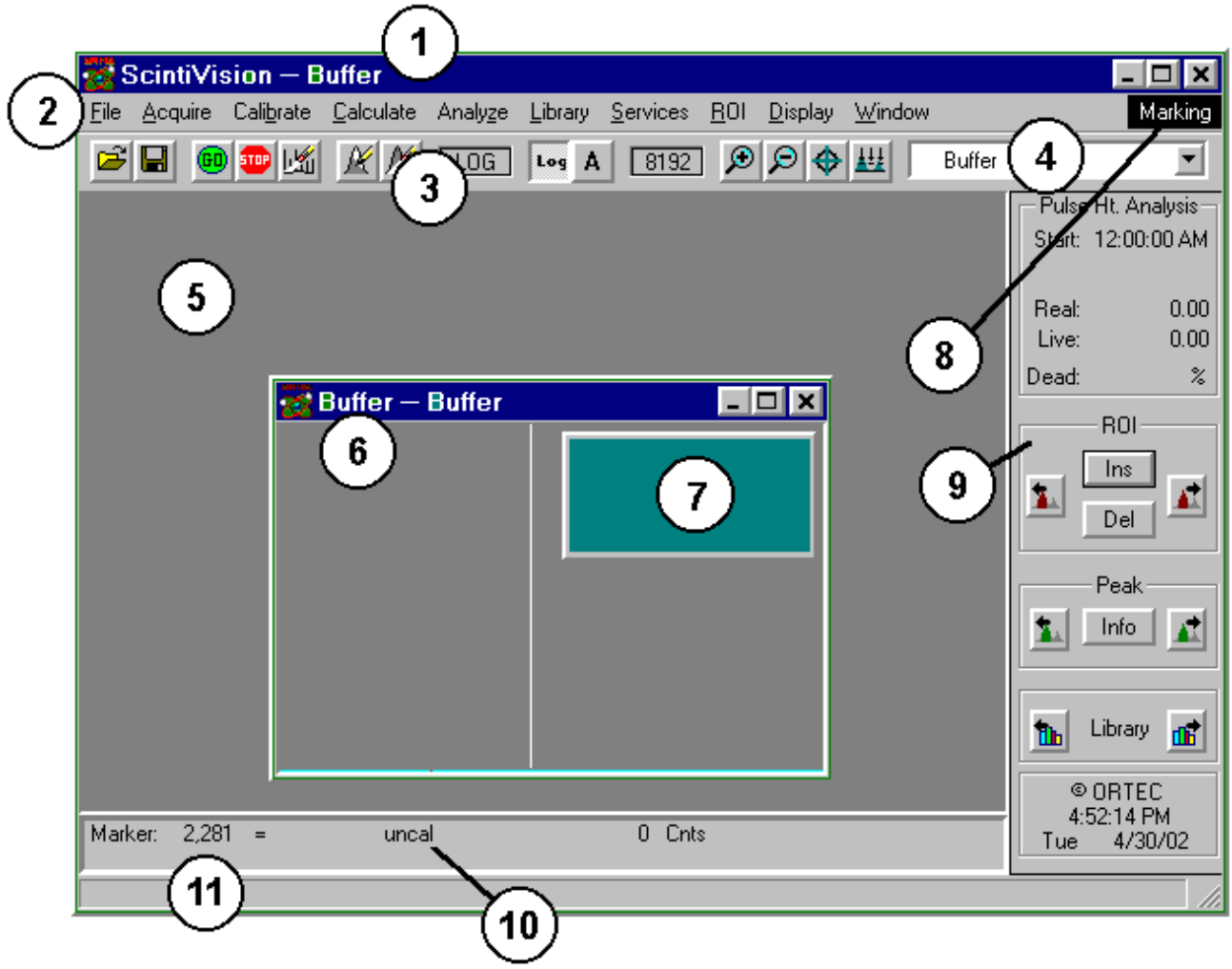


Fig. 33. Main ScintiVision Screen Features.

1. **Title bar**, showing the source of the currently displayed spectrum. This is either the Detector description; the word "Buffer" if the buffer is selected; or a file name, if a file has been saved or recalled and not yet modified (if a sample description has been entered for the file, it will accompany the file name). On the far right are the Minimize, Maximize, and Close buttons.

2. **Menu Bar**, showing the available menu commands (which can be selected with either the mouse or keyboard); these functions are discussed in detail in Chapter 5.

3. **Toolbar**, beneath the Menu Bar, contains icons for recalling spectra, saving them to disk, starting and stopping data acquisition, changing the point/fill characteristics of a spectrum, and adjusting the spectrum's vertical and horizontal scale. The name of the last Detector selected is shown.

4. **Drop-down Detector List**, on the Toolbar, displaying the currently selected Detector (or the buffer). Clicking on this field opens a list of all Detectors currently on the PC's ScintiVision Detector pick list, from which you can select a Detector or the buffer.

5. **Spectrum Area**, which can display one or more windows of data from Detectors, buffers, or spectrum files. These windows can be moved, sized, minimized, maximized, and closed with the mouse, as well as tiled horizontally or vertically from the **Window** menu. When more than one window is open, only one is *active* — available for data manipulation and analysis — at a time. The Title Bar on inactive windows will be gray (unless you have changed the color scheme in Windows Control Panel) while the active window's title bar will be a brighter color. To switch windows, click on the window you wish to view, or cycle between windows by pressing **<Ctrl + Tab>**.

   Each spectrum window contains a *Full Spectrum View* and an *Expanded Spectrum View* (see items 6 and 7 below).

6. The **Full Spectrum View** shows the full histogram from the file or the Detector memory. The vertical scale is always logarithmic, and the window can be moved and sized (see Section 4.3.4). The Full Spectrum View contains a rectangular window that marks the portion of spectrum now displayed in the Expanded Spectrum View. To quickly move to different part of the spectrum, just click on that area in the Full Spectrum View and the expanded display updates immediately at the new position.

7. The **Expanded Spectrum View** shows all or part of the full histogram; this allows you to zoom in on a particular part of the spectrum and see it in more detail. You can change the expanded view's vertical and horizontal scaling, and perform a number of analytical operations such as peak information, marking ROIs, or calibrating the spectrum. This window contains a vertical line called a *marker* that highlights a particular position in the spectrum. Information about that position is displayed on the Marker Information Line (see item 10 below).

8. **ROI Status Area**, on the right side of the menu bar, indicates whether the ROI marking mode is currently **Mark**, **UnMark**, or **Off**. This operates in conjunction with the **ROI** menu commands and arrow keys (see Section 5.8).

9. **Status Sidebar**, on the right side of the screen, providing information on the current Detector presets and counting times, the time and date, and a set of buttons that allow you to move easily between peaks, ROIs, and library entries (see Section 4.4).

10. **Marker Information Line**, beneath the spectrum, showing the marker channel, calibration, and contents.

11. **Supplementary Information Line**, below the Marker Information Line, used to show library contents, the results of certain calculations, warning messages, or instructions.

4.1. Spectrum Displays

The Full and Expanded Spectrum Views show, respectively, a complete histogram of the current spectrum (whether from a Detector or buffer) and an expanded view of all or part of the spectrum. These two windows are the central features of the ScintiVision-32 screen. All other windows and most functions relate to the spectrum windows. The Full Spectrum View shows the entire data memory of the Detector as defined in the configuration. In addition, it has a marker box showing which portion of the spectrum is displayed in the Expanded Spectrum View.

The Expanded Spectrum View contains a reverse-color marker line at the horizontal position of the pixel representing the marker channel. This marker can be moved with the mouse pointer, as described in Section 4.3.1, and with the <←>/<→> and <**PgUp**>/<**PgDn**> keys.

The spectrum display can be expanded to show more detail or contracted to show more data using the **Zoom In** and **Zoom Out** features.[6] Zooming in and out can be performed using the Toolbar buttons, the **Display** menu commands, or the *rubber rectangle* (see Section 4.3.3). The rubber rectangle allows the spectrum to be expanded to any horizontal or vertical scale. The baseline or "zero level" at the bottom of the display can also be offset with this tool, allowing the greatest possible flexibility in showing the spectrum in any detail.

The Toolbar and **Display** menu zoom commands offer a quick way to change the display. These change both the horizontal and vertical scales at the same time. For **Zoom In,** the horizontal width is reduced by about 6% of full width (ADC conversion gain) and the vertical scale is halved. The **Zoom In** button and menu item zoom to a minimum horizontal scale of 6% of the ADC conversion gain. For **Zoom Out,** the horizontal width is increased by about 6% of full width (ADC conversion gain) and the vertical scale is doubled.

[6]These replace the **Narrower/Wider** and **Shorter/Taller** commands in older versions of ScintiVision.

The **Keypad**<+> and **Keypad**<−> accelerator keys duplicate the **Zoom In** and **Zoom Out** Toolbar buttons and **Display** menu commands. The <**F5**>/<**F6**> and <↓>/<↑> keys change the vertical scale by a factor of two without changing the horizontal scale. The <**F7**>/<**F8**> and *keyboard* <−>/<+> keys change the horizontal scale by a factor of two without changing the vertical scale.

Depending on the expansion or overall size of the spectrum, all or part of the selected spectrum can be shown in the expanded view. Therefore, the number of channels could be larger than the horizontal size of the window, as measured in pixels. In this case, where the number of channels shown exceeds the window size, all of the channels cannot be represented by exactly one pixel dot. Instead, the channels are grouped together, and the vertical displacement corresponding to the maximum channel in each group is displayed. This maintains a meaningful representation of the relative peak heights in the spectrum. For a more precise representation of the peak shapes displaying all available data (i.e., where each pixel corresponds to exactly one channel), the scale should be expanded until the number of channels is less than or equal to the size of the window.

Note that the marker can be moved by no less than one pixel or one channel (whichever is greater) at a time. In the scenario described above, where there are many more memory channels being represented on the display than there are pixels horizontally in the window, the marker will move by more than one memory channel at a time, even with the smallest possible change as performed with the <→> and <←> keys. If true single-channel motions are required, the display must be expanded as described above.

In addition to changing the scaling of the spectrum, the colors of the various spectrum features (e.g., background, spectrum, ROIs) can be changed using the **Display** menu.

4.2. The Toolbar

The row of buttons below the Menu Bar provides convenient shortcuts to some of the most common ScintiVision menu functions.

The **Recall** button retrieves an existing spectrum file. This is the equivalent of selecting **File/Recall** from the menu.

Save copies the currently displayed spectrum to disk. It duplicates the menu functions **File/Save** or **File/Save As...** (depending on whether the spectrum was recalled from disk, and whether any changes have been made to the spectrum window since the last save).

Start Acquisition starts data collection in the current Detector. This duplicates **Acquire/Start** and **<Alt + 1>**.

Stop Acquisition stops data collection. This duplicates **Acquire/Stop** and **<Alt + 2>**.

Clear Spectrum clears the detector or file spectrum from the window. This duplicates **Acquire/Clear** and **<Alt + 3>**.

Mark ROI automatically marks an ROI in the spectrum at the marker position, according to the criteria in Section 5.8.4. This duplicates **ROI/Mark Peak** and **<Insert>**.

Clear ROI removes the ROI mark from the channels of the peak currently selected with the marker. This duplicates **ROI/Clear** and **<Delete>**.

The next section of the Toolbar (Fig. 34) contains the buttons that control the spectrum's vertical scale. These commands are also on the **Display** menu. In addition, vertical scale can be adjusted by zooming in with the mouse (see Fig. 40).

Fig. 34. Vertical Scaling Section of Toolbar.

Vertical Log/Lin Scale switches between logarithmic and linear scaling. When switching from logarithmic to linear, it uses the previous linear scale setting. Its keyboard duplicate is **Keypad</>**.

Vertical Auto Scale turns on the *autoscale* mode, a linear scale that automatically adjusts until the largest peak shown is at its maximum height without overflowing the display. Its keyboard duplicate is **Keypad<*>**.

The field to the left of these two buttons displays **LOG** if the scale is logarithmic, or indicates the current vertical full-scale linear value.

The horizontal scaling section (Fig. 35) follows next. It includes a field that shows the current window width in channels, and the **Zoom In**, **Zoom Out**, **Center**, and **Baseline Zero** buttons. These commands are also on the **Display** menu. In addition, horizontal scale can be adjusted by zooming in with the mouse (see Fig. 40).

Fig. 35. Horizontal Scaling Section of Toolbar.

Zoom In decreases the horizontal full scale of the Expanded Spectrum View according to the discussion in Section 4.1, so the peaks appear "magnified." This duplicates **Display/Zoom In** and **Keypad<+>**.

Zoom Out increases the horizontal full scale of the Expanded Spectrum View according to the discussion in Section 4.1, so the peaks appear reduced in size. This duplicates **Display/Zoom Out** and **Keypad<−>**.

Center moves the marker to the center of the screen by shifting the spectrum without moving the marker from its current channel. This duplicates **Display/Center** and **Keypad<5>**.

Baseline Zero switches to autoscale mode and sets the baseline of the Expanded Spectrum View to zero. Autoscale is then switched off.

NOTE In addition to the preceding commands, note the **Full View** command on the **Display** menu (duplicated by **<Alt+F7>**). This function adjusts the horizontal and vertical scaling to display the entire spectrum in the Expanded Spectrum View.

The right-most part of the Toolbar is a droplist of the available Detectors (Fig. 36). To select a Detector or the buffer, click in the field or on the down-arrow beside it to open the list, then click on the desired entry. The sidebar will register your selection.

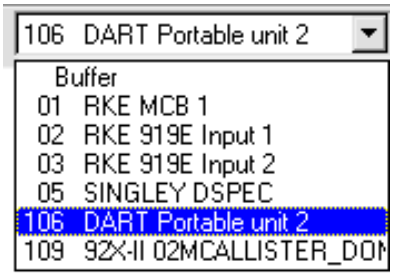


Fig. 36. Drop-Down Detector List.

Finally, note that as you pause the mouse pointer over the center of a Toolbar button, a pop-up *tool tip* box opens, describing the button's function (Fig. 37).

4.3. Using the Mouse

The mouse can be used to access the menus, Toolbar, and sidebars; adjust spectrum scaling; mark and unmark peaks and ROIs; select Detectors; work in the dialogs — every function in ScintiVision except text entry. For most people, this might be more efficient than using the keyboard. The following sections describe specialized mouse functions.

Fig. 37. Tool Tip.

4.3.1. Moving the Marker with the Mouse

To position the marker with the mouse, move the pointer to the desired channel in the Expanded Spectrum View and click the left mouse button once. This will move the marker to the mouse position. Click in the Full Spectrum View to move the expanded view to that place. This is generally a much easier way to move the marker around in the spectrum than using the arrow keys and accelerators, although you might prefer to mix mouse and keyboard commands.

4.3.2. The Right-Mouse-Button Menu

Figure 38 shows the right-mouse-button menu. To open it, position the mouse pointer in the spectrum display, click the right mouse button, then use the left mouse button to select from its list of commands. Not all of the commands are available at all times, depending on the spectrum displayed and whether the rubber rectangle is active. Except for **Undo Zoom In**, all of these functions are on the Toolbar and/or the Menu Bar (**Peak Info, Input Count Rate,** and **Sum** are only on the Menu Bar, under **Calculate**). See Section 5.10 for more information on the commands.

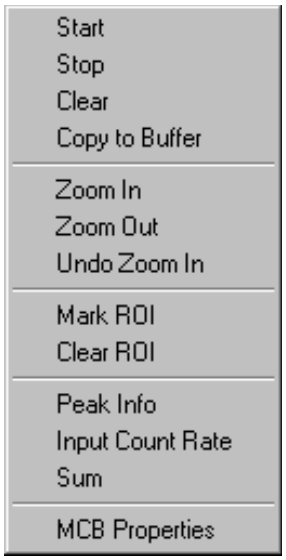


Fig. 38. Right-Mouse-Button Menu for Spectra.

4.3.3. Using the "Rubber Rectangle"

The *rubber rectangle* is used for selecting a particular area of interest within a spectrum. It can be used in conjunction with the right-mouse-button menu in Fig. 38 for many functions. To draw a rubber rectangle:

1. Click and hold the left mouse button; this anchors the starting corner of the rectangle.

2. Drag the mouse diagonally across the area of interest. As you do this, the mouse will be drawing a reverse-color rectangle bisected by the marker line. Note that when drawing a rubber rectangle, the marker line combines with a horizontal line inside the rectangle to form crosshairs (Fig. 39). They make it easy to select the center channel in the area of interest — this might be the center of an ROI that you wish to mark or unmark, a portion of the spectrum to be summed, or a peak for which you want detailed information.

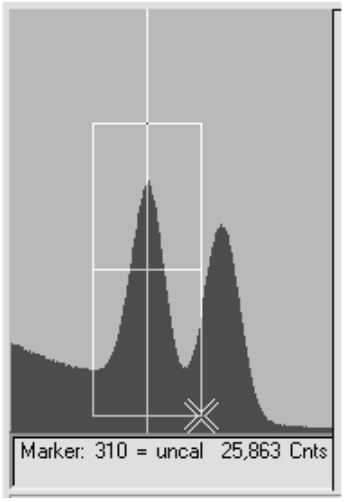


Fig. 39. The Rubber Rectangle's Crosshairs.

3. Release the mouse button; this anchors the ending corner of the rectangle.

4. Click the right mouse button to open its menu, and select one of the available commands. Once an area is selected, the commands can also be issued from the Toolbar, Menu Bar, Status Sidebar, or keyboard.

As an example, Fig. 40 illustrates the process of marking a region with a rubber rectangle and zooming in using the right-mouse-button menu.

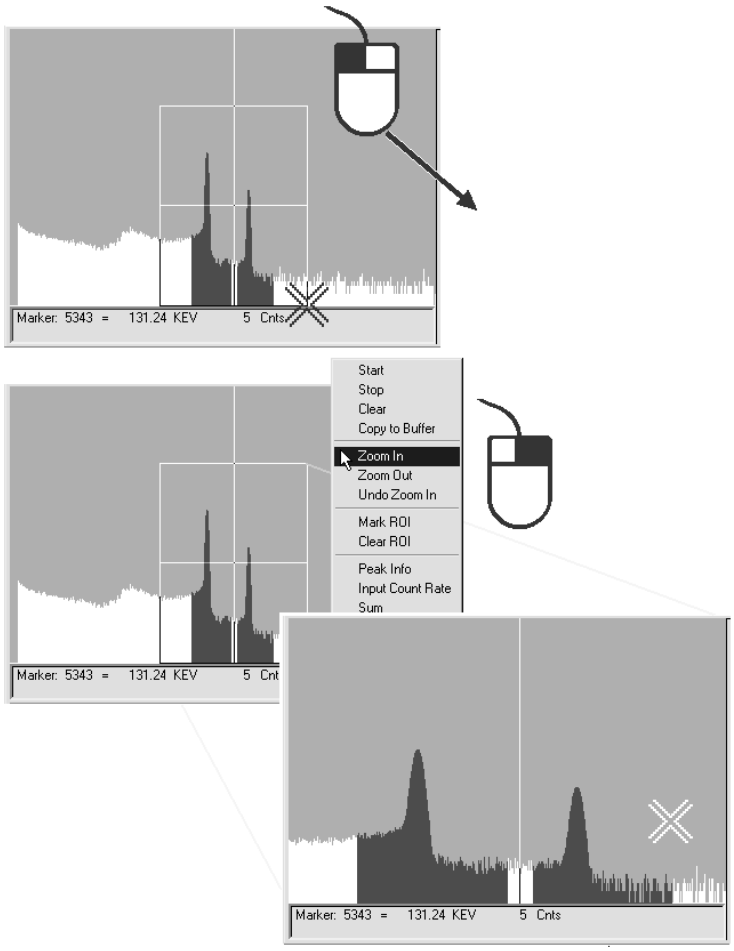


Fig. 40. Zooming In Using the Rubber Rectangle and Right-Mouse-Button Menu.

You can move the rectangle using the arrow keys. The **<Shift + ←>** and **<Shift + →>** keys move the box left and right, while **<Shift + ↑>** and **<Shift + ↓>** move the box up and down. This enables you to position the box more precisely.

4.3.4. Sizing and Moving the Full Spectrum View

To change the horizontal and vertical size of the Full Spectrum View, move the mouse pointer onto the side edge, bottom edge, or corner of the window until the pointer changes to a double-sided arrow (see Fig. 41). Click and hold the left mouse button, drag the edge of the window until it is the size you want, then release the mouse button.

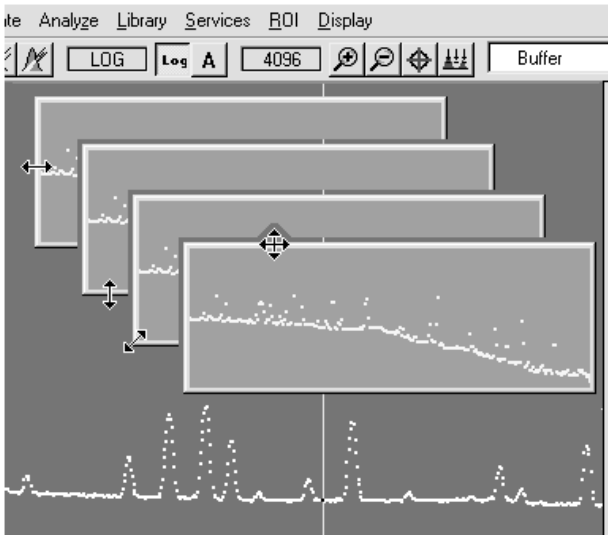


Fig. 41. Two-Sided Pointer for Sizing Full Spectrum View, and Four-Sided Pointer for Moving Window.

To move the Full Spectrum View to a different part of the screen, move the mouse pointer onto the top edge of the window until the pointer changes to a four-sided arrow (see Fig. 41). Click and hold the left mouse button, drag the window to its new location, and release the mouse button.

4.4. Buttons and Boxes

This section describes ScintiVision's radio buttons, indexing buttons, and checkboxes. To activate a button or box, just click on it.

Radio buttons (Fig. 42) appear on many ScintiVision dialogs, and allow you to select of only one of the choices.

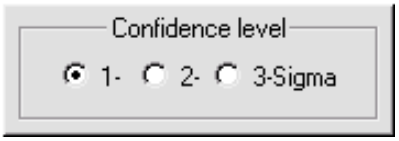


Fig. 42. Radio Buttons.

Checkboxes (Fig. 43) are another common feature, allowing you to select one or more of the options at the same time.

The **ROI**, **Peak**, and **Library** indexing buttons on the Status Sidebar are useful for rapidly locating ROIs or peaks, and for advancing between entries in the library. When the last item in either direction is reached, the computer beeps and ScintiVision posts a "no more" message on the Supplementary Information Line. If a library file has not been loaded or the Detector is not calibrated, the **Library** buttons are disabled and shown in gray.

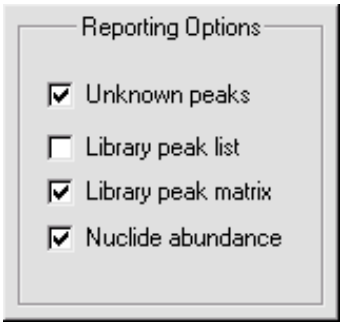


Fig. 43. Checkboxes.

The indexing buttons are displayed in two different ways, depending on whether ScintiVision is in Detector or buffer mode. This is shown in Fig. 44.

In Detector mode, the buttons appear at the bottom of the Status Sidebar. In buffer mode, the buttons are overlaid where the **Presets** and indexing buttons are displayed in Detector mode.

The **ROI**, **Peak**, and **Library** buttons function the same in both modes. In buffer mode, the additional features are the ability to insert or delete an ROI with the **Ins** and **Del** buttons, respectively (located between the **ROI** indexing buttons); and to display the peak information for an ROI with the **Info** button (located between the **Peak** indexing arrows).

The **Library** buttons are useful after a peak has been located to advance forward or backward through the library to the next closest library entry. Each button click advances to the next library entry and moves the marker to the corresponding energy.

Instead of using the **Peak** buttons to index from a previously identified peak, position the marker anywhere in the spectrum and click on the **Library** buttons to locate the entries closest in energy

to that point. If a warning beep sounds, it means that all library entries have been exhausted in that direction, or that the spectrum is not calibrated. In any case, if an appropriate peak is available at the location of the marker, data on the peak activity are displayed on the Marker Information Line at the bottom of the screen.

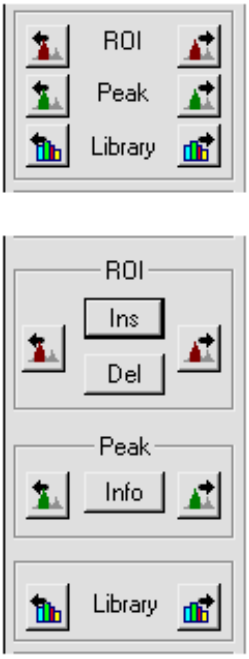


Fig. 44. Indexing Buttons (Detector mode, top; buffer mode, bottom).

The **ROI** and **Peak** indexing buttons are duplicated by **<Shift+ ←>/<Shift+ →>** and **<Ctrl+ ←>/<Ctrl+ →>**, respectively. The **Library** buttons are duplicated by **<Alt+ ←>/<Alt+ →>**. The **Del** button function is duplicated by the **<Delete>** key and **Clear ROI** on the menus and Toolbar. The **Ins** button has the same function as the **<Insert>** key and **Mark ROI** on the menus and Toolbar. The **Info** button duplicates the **Calculate/Peak Info** and the **Peak Info** command on the right-mouse-button menu.

4.5. Using the File Dialogs

ScintiVision provides a consistent user interface for all functions that involve reading files from or writing files to disk. The standard file recall/save dialog (see Fig. 45) includes a **Look in:** or **Save in:** box that allows the user to specify the drive and path-name, a list-of-files box, a **File name:** box, a **Files of type**: box, and, on certain dialogs, a **Show Description** checkbox that allows you to display a sample description, if available.

Any extension or filename can be entered in the **File name**: field. If this entry contains wildcards (* or ?) and the user clicks on **OK**, the list-of-files box will show the list of all files for the current drive and path that meet the wildcard requirements.

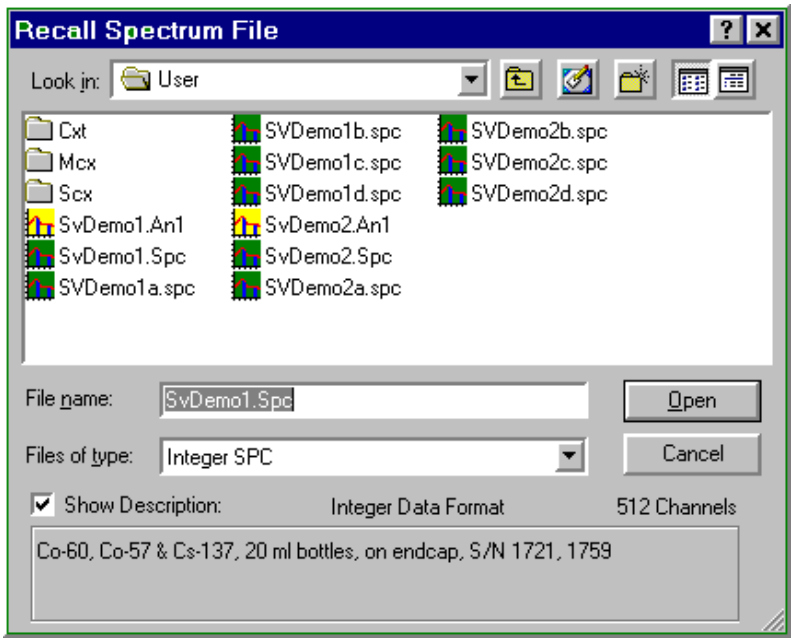


Fig. 45. Standard File Recall Dialog.

The default list of files is set to the appropriate file type for the function being performed. For example, in **File/ Recall**, if the default filename criterion, **Integer SPC**, is displayed in the **Files of type:** field, the list-of-files box will display *only* the files that have the extension **`.SPC`** or **`AN1`**. Similarly, in **File/ Import**, if the default filename criterion, **Txt Files**, is displayed, the list-of-files box will show only the **`.TXT`** files in that directory. In

addition to typing in a wildcard search, the **File of type:** field can also be used. Click on it to open its droplist, then choose one of its file extensions/types.

To recall an existing file, double-click on its filename in the list-of-files box; or enter its filename in the **File name:** field, then press **<Enter>** or click on **Open**.

When saving new data for which no file yet exists, enter the new filename in the **File name**: field and press **<Enter>** or click on **Save**.

The **Save As** dialog also allows the "reuse" of an existing filename by saving new data into an existing file. *Note that this completely overwrites (destroys) the previous data.* To do this, double-click on a filename from the list-of-files box or enter one of those existing filenames into the **File name:** field, then press **<Enter>** or click on **Save**. The system will display a message saying, "**This file already exists. Replace existing file?**" Click on **Yes** to save the new data or **No** to cancel the **Save As** operation.

4.5.1. Changing Drive and Pathname

There are two ways to change to another directory and/or drive: click on the **Look in:**/**Save in:** field to open a droplist of all drives and subdirectories on the PC (see Fig. 46); or click on the **Up One Level** button (just right of the **Look in:**/**Save in:** field) to move, one level at a time, to higher-level directories. In both cases, movement through the drives and directories is similar to using Windows Explorer.

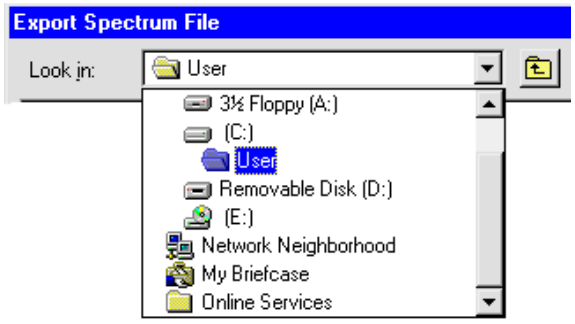


Fig. 46. Changing Drive and Pathname with the Droplist.

4.6. Help

ScintiVision provides two kinds of help: ***What's This?*** help on the buttons and features of the main screen, and ***Question Mark*** help on features, fields, and procedures within the dialog boxes.

To use **What's This?** help (Fig. 47), point the cursor at the desired screen feature and click the right mouse button. If help is available for that feature, a small **What's This?** box will open beside the cursor arrow. Left-click once on **What's This?** to open the help message. Press **<Esc>** to close help.

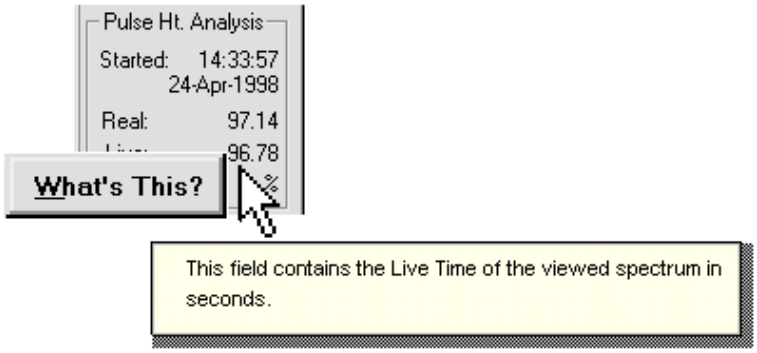


Fig. 47. "What's This?" Help.

To use **Question Mark** help (Fig. 48), locate the question mark (**?**) box on the various dialogs and sidebars. Left-click on the **?** (a **?** appears beside the arrow pointer), point at the feature you want to know about, and left-click to open the help message. Press **<Esc>** to close help.

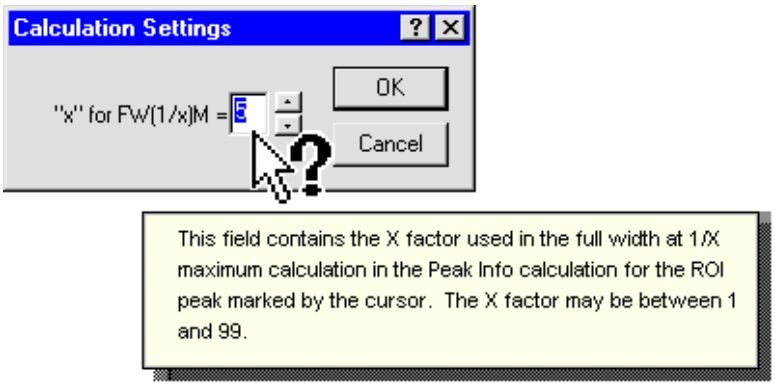

Calculation Settings
"x" for FW(1/x)M =
OK
Cancel
This field contains the X factor used in the full width at 1/X maximum calculation in the Peak Info calculation for the ROI peak marked by the cursor. The X factor may be between 1 and 99.

Fig. 48. "Question Mark" Help.

4.7. Drag and Drop

Several types of files can be selected and loaded into ScintiVision using the Windows *drag-and-drop* feature. The file types are: spectra (**`.SPC`**, **`.AN1`**, **`.CHN`**), calibration (**`.CLS`**), library (**`.LIB`**), analysis results (**`.UFO`**), peak background correction (**`.PBC`**), and region of interest (**`.ROI`**).

The drag-and-drop file is handled the same as a read (recall) operation for that type of file. For spectra, this means the file is loaded into a buffer and displayed. Library and PBC files become the working library and PBC files, respectively. The ROIs saved in an **`.ROI`** file are read and the regions set.

To drag and drop, open ScintiVision and Windows Explorer, and display both together on the screen. Locate a file in Explorer such as **`SVDEMO.ROI`**. Now click and hold the left mouse button,

move the mouse (along with the file “ghost”) to the ScintiVision window, and release the mouse button. The **.ROI** file will be read and the regions set.

4.8. Associated Files

When ScintiVision is installed, it registers the spectrum files in Windows so they can be opened from Windows Explorer by double-clicking on the filename. The spectrum files are displayed in WINPLOTS. These files are marked with a spectrum icon ( ) in the Explorer display. The **.JOB**, **.EFT**, and **.ENT** files are also registered, and have an ORTEC icon ( ). They open in Windows Notepad.

4.9. Editing

Many of the text entry fields in the ScintiVision dialogs support the Windows editing functions on the right-mouse-button menu. Use these functions to copy text from field to field with ease, as well as from program to program. Position the mouse pointer in the text field and click the right mouse button to open the menu shown in Fig. 49. Select a function from the menu with the left mouse button.

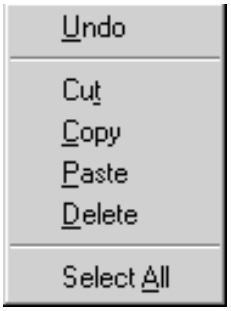


Fig. 49. Right-Mouse-Button Menu for Dialogs.

5. MENU COMMANDS

This chapter describes all the ScintiVision menu commands and their associated dialogs. As is customary for Windows menus, the accelerator(s) (if any) are shown to the right of the menu function they duplicate. Also, the underlined letter in the menu item indicates a key that can be used together with the **<Alt>** key for quick access in the menu. (So, for example, the **Detector...** dialog under **Display** can be reached by the following key sequence: **<Alt + D>**, **<Alt + D>**.) The ellipsis (**...**) following a menu selection indicates that a dialog is displayed to complete the function. Finally, a small arrow ("▸") following a menu selection means a submenu with more selections will be shown. The menus and commands are:

File

- Settings...
- Recall...
- Save
- Save As...
- Export...
- Import...
- Print....
- Compare...
- Exit
- About ScintiVision...

Acquire

Acquisition Settings...	
Start	<Alt + 1>
Start/Save/Report	
Stop	<Alt + 2>
Clear	<Alt + 3>
Copy to Buffer	<Alt + 5>
QA	
Settings...	
Measure Background	
Measure Sample	
Status...	
Control Chart...	
Download Spectra	
ZDT Display Select	<F3>
MCB Properties...	

Calibrate
- Energy...
- Efficiency...
- Description...
- Lower Limit
- Learn Calibration Sequence
- Run Calibration Sequence
- Recall Calibration...
- Save Calibration...
- Print Calibration...

Calculate
- Settings...
- Peak Info
- Input Count Rate
- Sum
- Smooth
- Strip...

Analyze
- Settings ▸
  - Sample Type...
  - Report Generator...
  - Attenuation Coefficients
  - Geometry Correction
  - Peak Background Correction ▸
    - Select PBC...
    - Edit PBC...
- Peak Search
- ROI Report...
- Entire Spectrum in Memory...
- Spectrum on Disk...
- Display Analysis Results...
- Interactive in Viewed Area...

Library
- Select Peak...
- Select File...
- Edit ▸
  - ScintiVision Editor...
  - Nuclide Navigator...
- List...

Services

- Job Control...
- Sample Description...
- Menu Passwords...
- Lock/Unlock Detector...
- Edit Detector List...

ROI

Off	<F2> or <Alt + O>
Mark	<F2> or <Alt + M>
UnMark	<F2> or <Alt + U>
Mark Peak	<Insert>
Clear	<Delete>
Clear All	
Save File...	
Recall File...	

Display

Detector...	<Ctrl + Fn>
Detector/Buffer	<F4> or <Alt + 6>
Logarithmic	Keypad(/)
Automatic	Keypad(*)
Baseline Zoom	
Zoom In	Keypad(+)
Zoom Out	Keypad(−)
Center	Keypad(5)
Full View	<Alt + F7>
Preferences ▸	

- Points
- Fill ROI
- Fill All
- Fill Singlets
- Fill Multiplet Peaks
- Fill Multiplet Composites
- Spectrum Colors...
- Peak Info Font/Color...

Right-Mouse-Button Menu

Start
Stop
Clear
Copy to Buffer
Zoom In
Zoom Out
Undo Zoom In
Mark ROI
Clear ROI
Peak Info
Input Count Rate
Sum
MCB Properties

5.1. File

The **File** menu gives access to the spectrum file save, recall, printing and compare functions and is shown in Fig. 50.

Fig. 50. File Menu.

5.1.1. Settings...

The **File Settings** dialog (see Fig. 51) allows you to specify how the spectrum data are saved, exported, imported, and to set the directories for all the major file types used by ScintiVision.

5.1.1.1. General

The entries on this tab control the file type and which questions are automatically asked (or the defaults for these questions).

The file types are integer **.CHN**, integer **.SPC**, floating-point **.SPC**, and ASCII **.SPE**. The **.CHN** file format is the format used by all versions of MAESTRO. It is the simplest format and, therefore, the easiest to read with other programs. It does not contain the analysis parameter data, the complete calibration, or other data needed for the nuclide analysis. The format is described in the *ORTEC Software File Structure Manual for DOS and Windows Systems* (P/N 753800, hereinafter referred to as the *File Structure Manual*).

The two **.SPC** formats, integer and floating-point, are identical except for the format of the spectrum data. The integer **.SPC** format should be used unless the files are to be used by earlier versions of ORTEC programs. Both contain all of the analysis parameters (from analysis settings) and the complete calibration data. They are suitable for archiving, as the analysis can

be reproduced from this file. The integer format stores the spectrum as 4-byte integers and the floating-point format uses the 4-byte exponential format used in the hardware math coprocessor (e.g., 80387) and most languages for the PC. The analysis and calibration formats are defined in the *File Structure Manual*. The **.SPE** format is used by the Comprehensive Test Ban Treaty Organization (CTBTO) and is described in the ORTEC file structure manual.

The **Sample Description** can be entered here. It can also be asked for when the spectrum is saved. If the **Sample Description** box is checked, the entry here will be the default presented in the file-save dialog. This would save time when working with several similar samples — the common description could be entered on this dialog and the unique descriptors added on this dialog.

If the output activity is to be normalized to a volume or weight (or any other factor), the sample quantity can be entered here along with the reporting units. This will normalize the activity, and the report will be in normalized units. This normalization is in addition to the normalization done by the multiplier and divisor on the System tab of the Analysis Options dialog (**Analyze/Settings/ Sample Type...**).

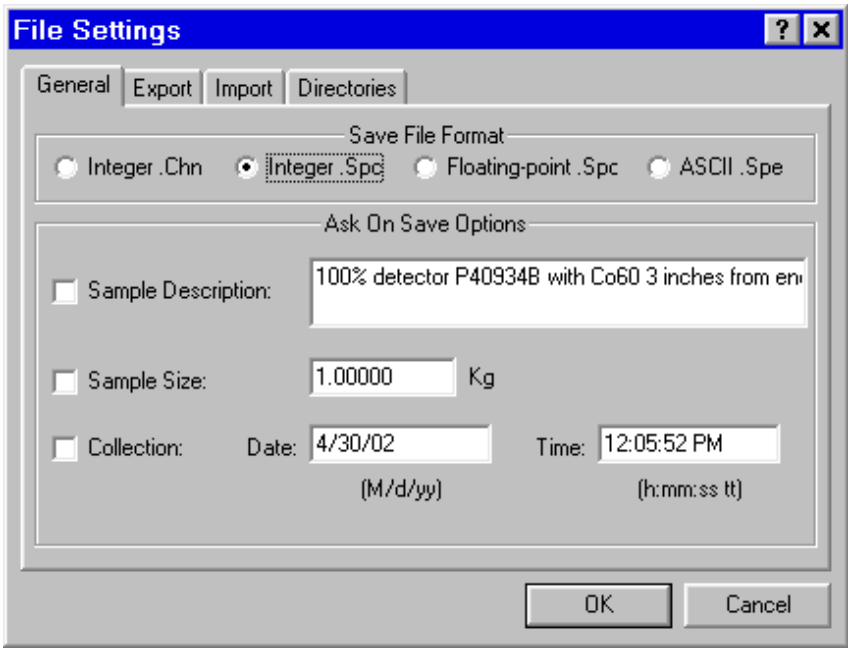


Fig. 51. General Tab.

The collection date and time are the time used in the decay correction. If the decay correction is enabled (see the Sample tab of the Analysis Options dialog), this is the date used in the correction formula.[7]

Click on **OK** to use these settings until the next time they are changed. See **Acquire/Acquisition Settings...** (Section 5.2.1) and **Analyze/Settings/Sample Type...** for other adjustable parameters.

[7]If the collection date and time is before that of the spectrum acquisition, the spectrum will be activity corrected back to the sample collection time. While this is the normal use of this input, if the collection date and time is after the acquisition time, the decay correction will be made forward in time.

5.1.1.2. Export

The Export tab (Fig. 52) is used to specify the program, arguments, and file directory to be used when the **Export...** function is selected.

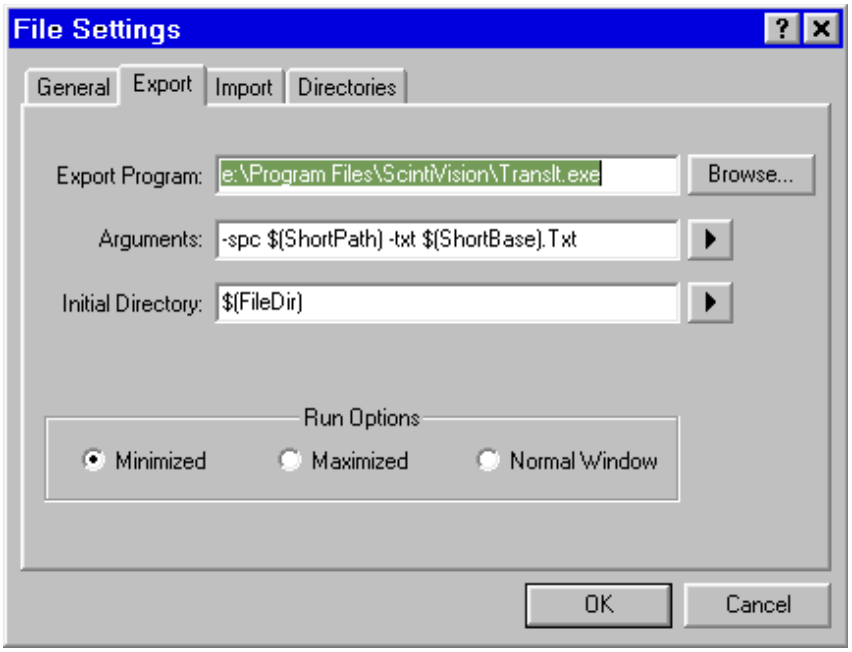


Fig. 52. Export Tab.

Choose any program[8] that can accept the spectrum filename as an argument on the command line. Click on **Browse...** to automatically select the complete proper path for the program.

Arguments:

The **Arguments:** to the program can be specified as directly entered character strings or the user can select from the list of "macros" shown in Fig. 53. The list is displayed by clicking on the arrow button to the right of the **Arguments:** field. Entries (macros or direct) must be separated by spaces to be read as separate arguments.

File Path Name

This will insert the complete file pathname (e.g., **`c:\user\spectrum\test.spc`**) into the dialog box. The filename is the name selected in the filename entry dialog.

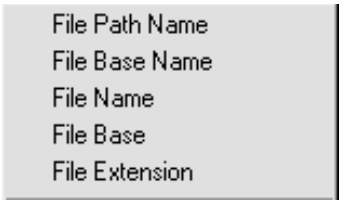


Fig. 53. Export Argument Macros.

File Base Name

This will insert the file path name *without* the extension (e.g., **`c:\user\spectrum\test`**) into the dialog box. The filename is the name selected in the filename entry dialog. The extension can be entered manually after the macro (e.g., **`$(FullBase).Spc`**) into the dialog box. *Note that the "dot" (.) must also be entered*. Related filenames can also be made by adding characters before the "dot" (e.g., **`$(FullBase)A.Spc`**).

[8]Any executable program that can be executed from the Windows **Run** command can be selected, including DOS batch commands.

File Name

This will insert the filename (e.g., **`test.Spc`**) into the dialog box. The filename is the name selected in the filename entry dialog. **File Name** can be constructed as **`[file base].[file extension]`**.

File Base

This will insert the base filename (e.g., **`test`**) into the dialog box. The file base name is the name selected in the filename entry dialog.

File Extension

This will insert the file extension (e.g., **`Spc`**) into the dialog box. The file extension is the name selected in the filename entry dialog. *Note that the "dot" is not included.*

Any manually inserted input of the macro form (**`$(xxx)`**) will be included in the argument list without changes.

Initial Directory

The initial directory for the program to use can be specified as directly entered character strings or the user can select from the list of macros in Fig. 54. The list is displayed by clicking on the arrow button to the right of the **Initial Directory:** field.

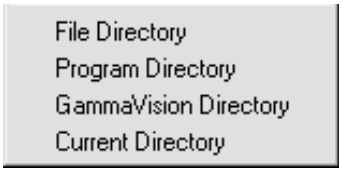


Fig. 54. The Initial Directory Macros.

File Directory

This is the directory selected in the filename selection dialog when the export file is selected (e.g., **`c:\user\spectrum\`**).

Program Directory

This is the directory for the conversion program. It is shown in the first entry of this dialog.

ScintiVision Directory

This is the directory where the ScintiVision program is stored. Usually this is **`c:\Program Files\ScintiVision`**.

Current Directory

This is the current default directory for Windows.

Run Options

These three radio buttons (**Minimized**, **Maximized**, and **Normal Window**) are used to select the window for the program. If the program does not have any user dialogs, any option can be selected. If the program needs user inputs, **Normal Window** should be selected.

5.1.1.3. Import

Click on the Import tab to display the dialog shown in Fig. 55. The program to be executed and the default file extension when the **Import...** function is selected can then be specified. Choose any program that can accept the spectrum filename on the command line. Click on **Browse...** to automatically select the complete proper path for the program.

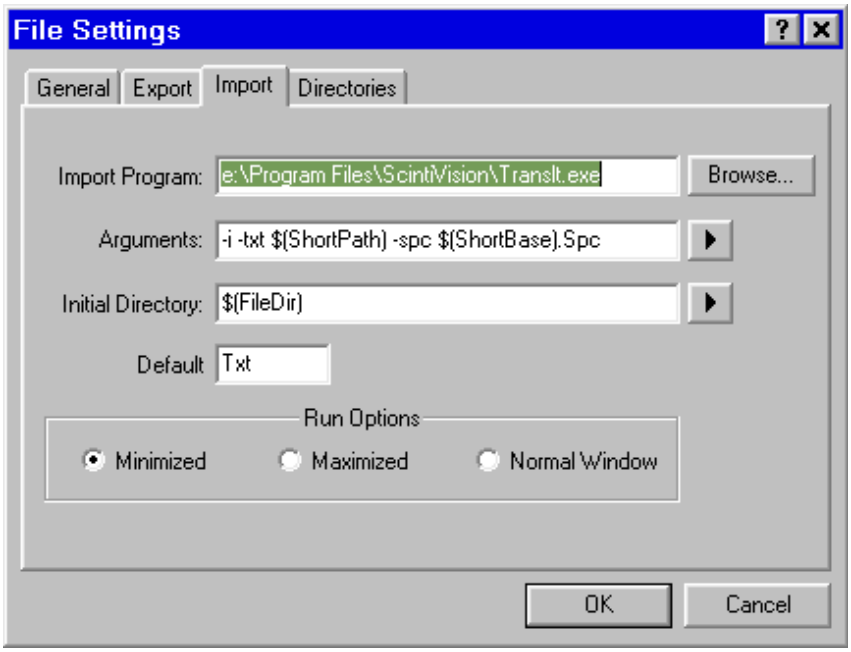


Fig. 55. Import Tab.

Arguments:

The arguments to the program can be specified as directly entered character strings or you can select from the list of macros shown in Fig. 56. The list is displayed by clicking on the arrow button to the right of the **Arguments:** field. The entries (macros or direct) must be separated by spaces to be read as separate arguments.

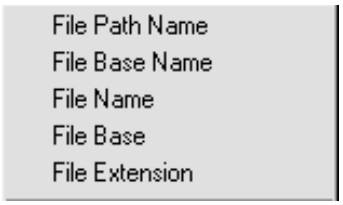


Fig. 56. Import Arguments.

File Path Name

This will insert the *complete* file path name (e.g., `c:\user\spectrum\test.txt`) into the dialog box. The filename is the name selected in the filename entry dialog.

File Base Name

This will insert the file path name *without* the extension (e.g., **`c:\user\spectrum\test`**) into the dialog box. The filename is the name selected in the file name entry dialog. The extension can be entered manually after the macro (e.g., **`$(FullBase).Spc`**) into the dialog box. *Note that the "dot" (.) must also be entered*. Related filenames can also be made by adding characters before the "dot" (e.g., **`$(FullBase)A.Spc`**).

File Name

This will insert the filename (e.g., **`test.TXT`**) into the dialog box. The filename is the name selected in the filename entry dialog. **File Name** can be constructed as **`[file base].[file extension].`**

File Base

This will insert the base filename (e.g., **`test`**) into the dialog box. The file base name is the name selected in the filename entry dialog.

File Extension

This will insert the file extension (e.g., **`TXT`**) into the dialog box. The file extension is the name selected in the filename entry dialog. *Note that the "dot" is not included*.

Any manually entered input of the macro form (**`$(xxx)`**) will be included in the argument list without changes.

Initial Directory

Specify the initial directory for the program to use either with directly entered character strings or by selecting from the list of macros shown in Fig. 57. The list is displayed by clicking on the arrow button to the right of the **Initial Directory:** field.

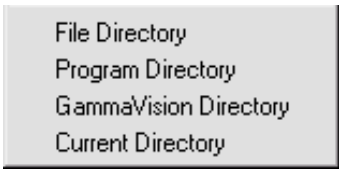


Fig. 57. Import Macros.

File Directory

This is the directory selected in the filename selection dialog when the import file is selected (e.g., **`c:\user\spectrum\`**).

Program Directory

This is the directory for the conversion program. It is shown in the first entry of this dialog.

ScintiVision Directory

This is the directory where the ScintiVision program is stored. Usually this is **`c:\Program Files\ScintiVision`**.

Current Directory

This is the current default directory for Windows.

Default

The default extension entered here is used as the extension for the filename in the filename entry dialog. For example, if **`TXT`** is entered, then the name list in the entry dialog will be **`*.TXT`**.

Run Options

These three radio buttons (**Minimized**, **Maximized**, and **Normal Window**) are used to select the window for the program. If the program does not have any user dialogs, any option can be selected. If the program needs user inputs, **Normal Window** should be selected.

5.1.1.4. Directories

Use this tab (Fig. 58) to select the default file directories for libraries, calibrations, **`.JOB`** files, and other files.

To change the path (**Location**) of a particular **File Type**, click on the desired file type to highlight it, then click on **Modify...**. This will open a standard file-recall dialog. Choose a new path and click on **Open** (see Section 4.5.1 for instructions on changing drives and folders). When all path changes have been completed, click on **OK** to use them or **Cancel** to retain the previous settings.

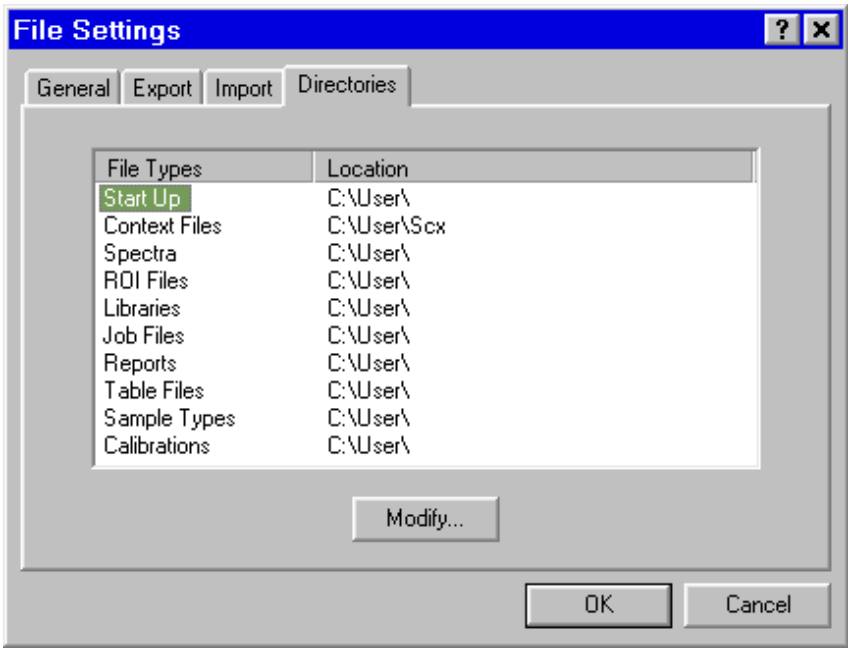


Fig. 58. Directories Tab.

5.1.2. Recall...

This function reads a spectrum file into a buffer window. The buffer must be selected first. The spectrum files are created by ScintiVision's **Save** and **Save As...** functions and by any other

programs that can produce the **.CHN**, **.SPC**, or **.SPE** format (e.g., MAESTRO-32, GammaVision®-32). The buffer is resized to the memory size of the recalled spectrum.

The **Recall Spectrum File** dialog (Fig. 59) shows a list of files, as described in Section 4.5.

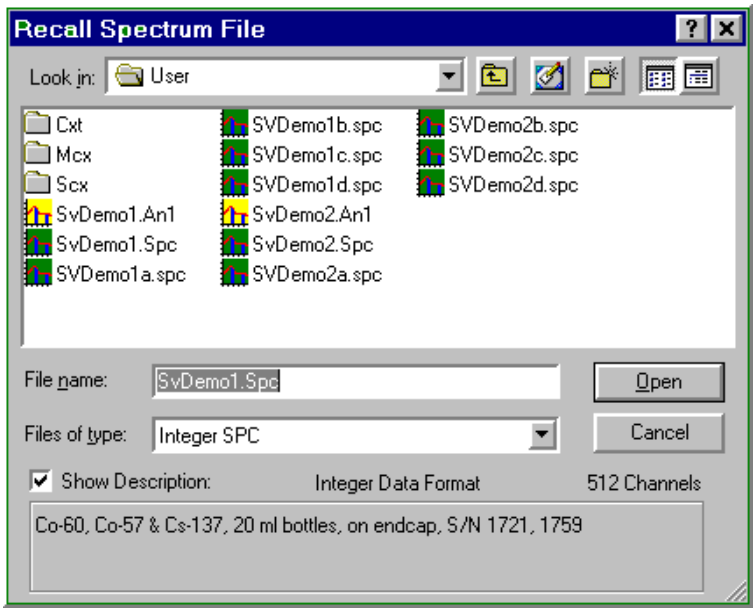


Fig. 59. Recall a Spectrum File.

Note the **Show Description:** checkbox on the lower left of the dialog. Use this to display the sample description, format, and spectrum size of each file without having to open it. Spectra up to 16k (16384) channels can be recalled and analyzed.

When the spectrum is successfully recalled, ScintiVision loads its descriptors (start time, live time, real time, Detector and sample descriptions) and calibration information (if any), and displays the filename on the Title Bar.

For spectrum files containing multiple spectra (such as ZDT mode in the DSPEC Pro or Plus), both spectra are automatically recalled.

5.1.3. Save/Save As...

These functions save the current spectrum to disk. The **Save Spectrum File** dialog (Fig. 60) opens when **Save As...** is selected, when **Save** is selected for a spectrum that has no previous filename associated with it, or after any operation is performed that can alter the spectrum.

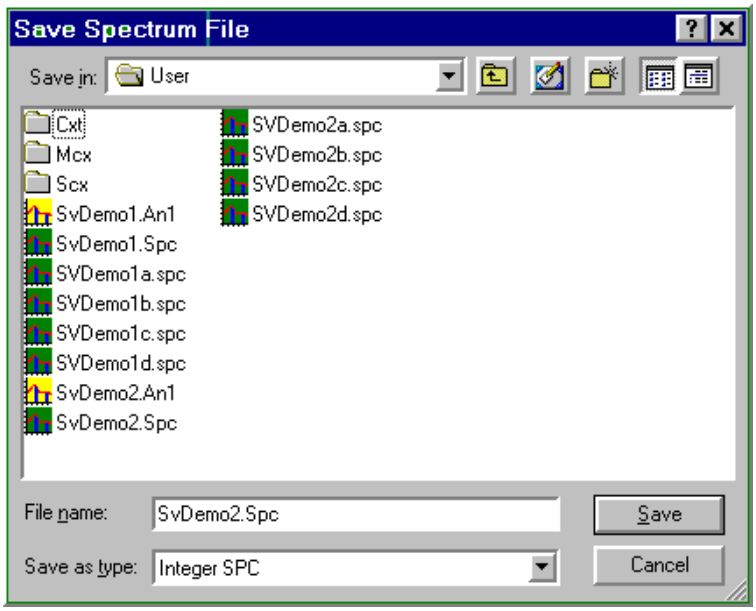


Fig. 60. Save As.

Enter any valid filename (consisting of an optional drive and directory, a filename, and an optional extension) in the **File name:** field and click on **Save** (refer to Section 4.5 for details on using this dialog). The recommended and default extension are shown in the dialog according to the format chosen. If that file

already exists, a message box opens asking you to verify the entry or cancel the operation. Clicking on **OK** will completely overwrite the existing file. After the disk file has been saved, its filename is displayed on the Title Bar.

The format selected is used rather than the type specified on the General tab under **File/Settings...** (Section 4.1.1.1.) which is the default here. The file extension should be left at the default setting to avoid confusion. This is especially true if the spectra are to be used in non-ORTEC programs.

For hardware with multiple spectra (such as ZDT mode in the DSPEC Plus), both spectra are automatically saved in the file.

5.1.4. Export...

The **Export...** function is used to write spectra in formats other than the usual formats, or to perform other functions such as plotting or printing the spectrum directly. The export program is specified on the Export tab under **File/Settings...**, as discussed in Section 5.1.1.2. The program can be one of the programs supplied or can be user-supplied. When selected, the **Export Spectrum File** dialog, shown in Fig. 61, is displayed. Choose the filename of the spectrum to be exported.

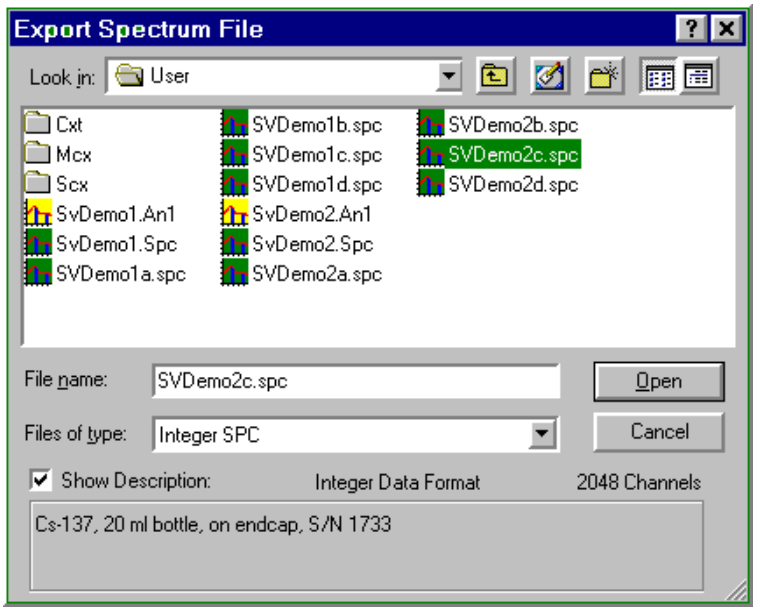


Fig. 61. The Export Spectrum File Dialog.

The currently displayed spectrum must be saved to disk before it can be exported. If the currently displayed spectrum has already been stored to disk, that filename is the default. Any file can be selected. The file is then read and the output file is written by the program.

The **Export...** function is not available for a second file until the first file has been exported and the export program has stopped execution.

Export... can also be used to generate hardcopy plots. To do this, select the WINPLOTS program (supplied with ScintiVision) as the export program. When **Export...** has been selected, the WINPLOTS program will be executed. If the `-P` switch is specified on the command line (see Sections 5.1.1.2 and 11.1.3), the program will plot the spectrum and exit automatically.

5.1.5. Import...

The **Import** function is used to read spectrum files that are not in one of the usual formats (i.e., `.CHN` or `.SPC`). The import program is specified on the Import tab under **File/Settings...**, as discussed in Section 5.1.1.3. The program can be one of the programs supplied or can be user-supplied. When selected, the **Import File** dialog (see Fig. 62) is displayed and you select the filename. The file is then read and a spectrum file is written to the specified directory. ScintiVision attempts to read this file (in `.CHN` or `.SPC` format) and displays the spectrum. If the Import program does not produce a file that ScintiVision can read, no spectrum is displayed.

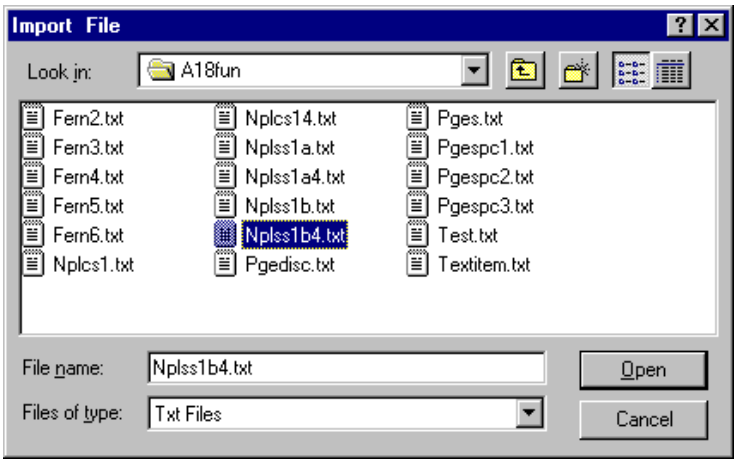


Fig. 62. The Import File Dialog.

5.1.6. Print

The **Print** function does one of the following:

- If the marker is in an ROI, the data contents of the ROI channels are printed.
- If the marker is not in an ROI, the contents of the channels in the spectrum window are printed.

The data are formatted at seven channels per line with the channel number on the left.

Use the **Print** dialog to print the output or save it in a disk file (click on **Print to file** to mark it). Click on **Properties** to change print options such as paper orientation and resolution.

5.1.7. Compare...

This function displays a spectrum from disk along with the current spectrum so the two can be visually compared. When **Compare Spectra...** is selected, a standard file-recall dialog box opens (see Section 4.5 or 5.1.2). Once the desired spectrum file is selected, the spectrum window shows both spectra, as illustrated in Fig. 63. Note that the spectra in this illustration are displayed in **Fill All** mode, in which all of the area under the peaks is filled with a color different from the background (see **Display/Preferences/Fill All**, Section 5.9.10.1).

For the DSPEC-series instruments that have ZDT mode, both spectra (live-time-corrected [LTC] or uncertainty [ERR] and ZDT) are compared. **Normal** refers to LTC or ERR; **Corrected** refers

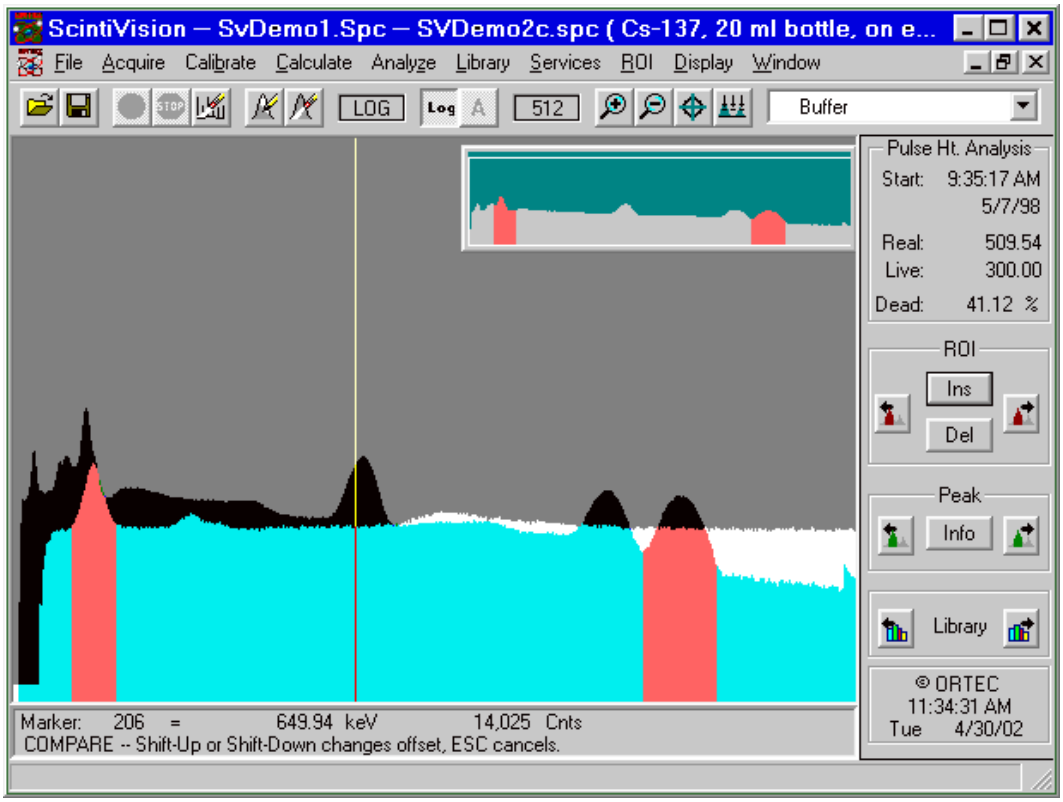


Fig. 63. Compare Mode Screen.

to ZDT. Use **<F3>** to switch between **Normal** and **Corrected** for both spectra, that is, to show **Normal/Normal** or **Corrected/Corrected**. To switch only the comparison between **Normal** and **Corrected**, use **<Shift + F3>**, that is, to show **Normal/Corrected** use **<Shift + F3>**.

The Compare spectrum is offset from the starting spectrum and can be moved up and down incrementally with the **<Shift + ↑>** and **<Shift + ↓>** accelerators. In addition, the vertical scale of both spectra can be simultaneously changed with <↑> and <↓>.

Note that the Compare spectrum's ROIs (if any were saved with the file) are not marked in this mode.

Figure 64 is a detailed view of a portion of Fig. 63. In this illustration, the starting spectrum is displayed in color **(1)**, the Compare spectrum is shown in color **(2)**, the portion of the starting spectrum that exceeds the Compare spectrum is indicated by color **(3)**, and the starting spectrum's ROIs are marked in color **(4)**. These colors (called **Foreground**, **Compare**, **Composite**, and **ROI**, respectively) are chosen on the **Color Preferences** dialog discussed in Section 5.9.10.3.

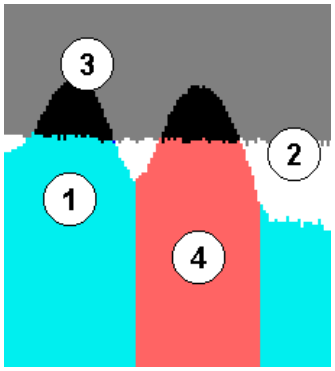


Fig. 64. Spectrum Colors in Compare Mode.

Press **<Esc>** to leave Compare mode.

5.1.8. Exit

This exits ScintiVision and returns to Windows. If the buffer contains a spectrum that has not been saved, a warning message is displayed. Any JOBs are terminated. All MCBs continue to acquire data until the presets are met.

5.1.9. About ScintiVision...

Figure 65 shows the **About** box for ScintiVision. It provides software version information that will be useful should you need customer support.

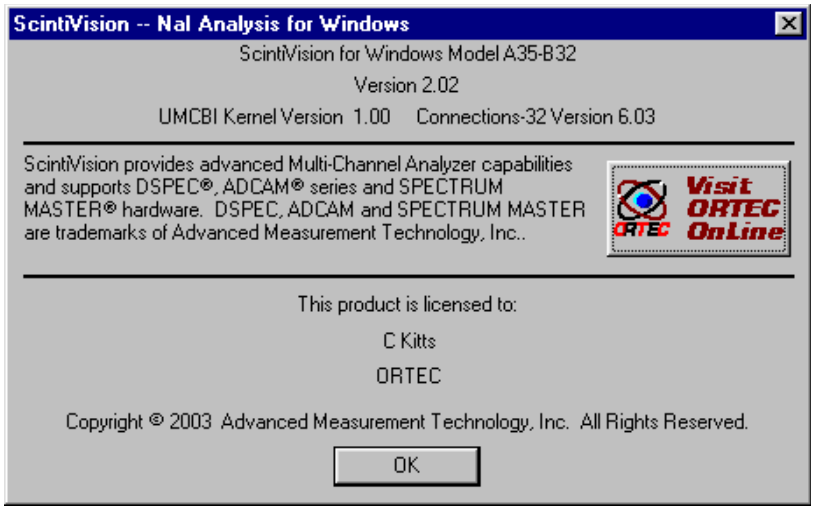

ScintiVision -- NaI Analysis for Windows
ScintiVision for Windows Model A35-B32
Version 2.02
UMCBI Kernel Version 1.00 Connections-32 Version 6.03
ScintiVision provides advanced Multi-Channel Analyzer capabilities and supports DSPEC®, ADCAM® series and SPECTRUM MASTER® hardware. DSPEC, ADCAM and SPECTRUM MASTER are trademarks of Advanced Measurement Technology, Inc..
Visit ORTEC OnLine
This product is licensed to:
C Kitts
ORTEC
Copyright © 2003 Advanced Measurement Technology, Inc. All Rights Reserved.
OK

Fig. 65. About ScintiVision.

If you are connected to the Internet, click on the **Visit ORTEC OnLine** button to browse our website which, in addition to our product catalog, includes application notes, technical papers, information on training courses, and access to our Global Service Center.

5.2. Acquire

The **Acquire** menu is shown in Fig. 66. Access to the various functions depends on whether the software is in Detector or buffer mode. **Download Spectra** is only available for the digiDART and DART. **View ZDT Corrected** is only valid for the DSPEC Pro, DSPEC jr 2.0, and DSPEC Plus.

NOTE In some cases, a Detector option might be grayed because it is disabled for the current Detector (while it might still be valid for some other Detector in the system, or for this Detector under different conditions).

5.2.1. Acquisition Settings...

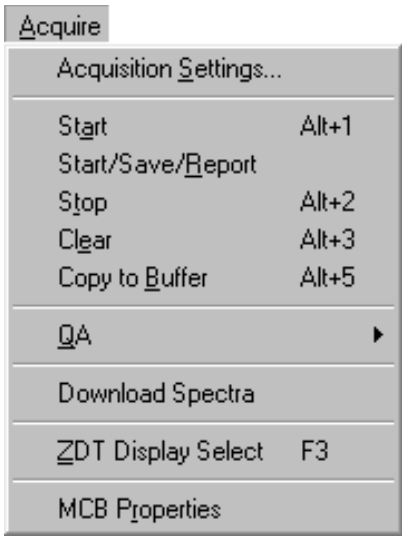


Fig. 66. Acquire Menu.

This command opens the Acquisition Settings dialog (Fig. 67), which allows you to control a number of questions that can be "asked on start" (when a Detector is started) and their default values.

5.2.1.1. Start/Save/Report

For the **Start/Save/Report** function, there are two selections to be made. One is to select the automatic clear of the Detector before the Detector is started (**Clear at Start**); and the second is to specify the base filename of the save file (**File Prefix:**) and whether the filename is to be automatically incremented after each use (**Auto-Increment**). The **File Prefix** can be up to eight alphanumeric characters. However, if **Auto-Increment** is specified, the limit is seven characters. The first one to seven characters of the filename are the file prefix. The remaining characters are the sequence numbers. This starts with the number entered in the **Save File #** field. The number increments to the number of allowed characters (e.g., **`AAAAAA99`**) then restarts at zero (e.g., **`AAAAAA00`**). The prefix must be short enough to accommodate the number of expected files. The filename is expanded to eight characters with zeros. If the **Auto-Increment** box is checked, the filename will be incremented by 1 each time the **Start/Save/Report** is done. For example, if 0 were entered for prefix **`svx`**, the first filename would be **`svx00000`**, the second would be **`svx00001`**, and so on.

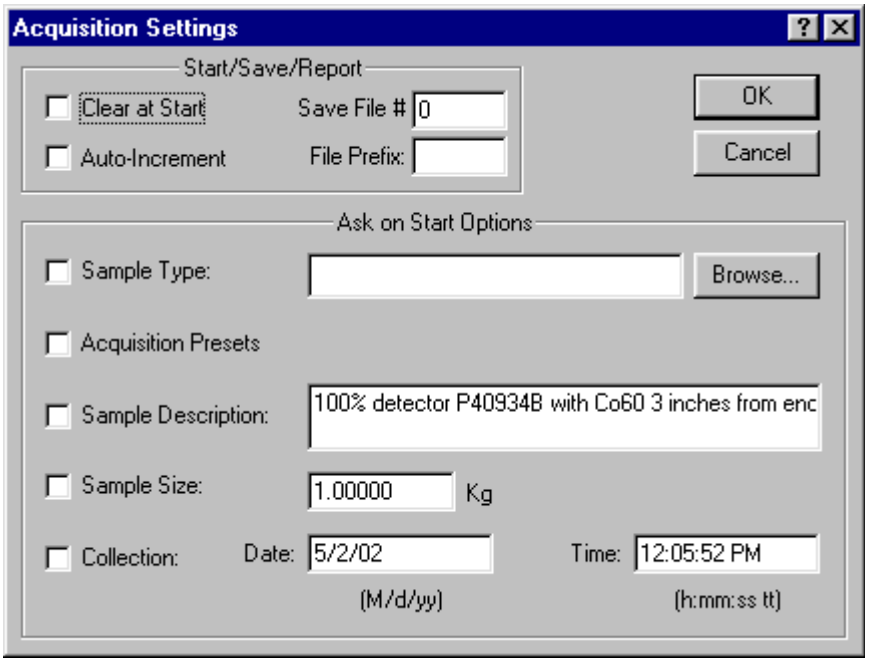


Fig. 67. Acquisition Settings.

If the **Auto-Increment** box is not checked, the same file is used for every analysis and the previous data are overwritten with each **Start/Save/Report**. The analysis uses the settings from **Analyze/Settings/Sample Type...** (Section 5.5.1.1).

5.2.1.2. Ask on Start Options

Sample Type Defaults

The sample type file, which contains many of the parameters needed for analysis and acquisition, can be specified here. The file is created in the Analysis Options dialog, Section 5.5.1.1. When specified, the file is read and the values in it are the defaults for this dialog. If the **Ask on Start** box is checked, ScintiVision will ask for the sample type when Detector acquisition starts, and the values in that file will be used. Click on **Browse...** to show the available files.

Acquisition Presets

If the **Ask on Start** box is checked, the presets are asked when the Detector is started; the dialog is the same as the Preset tab for this Detector's MCB Properties dialog. Only the non-zero presets can be changed during the start.

Sample Description

The sample description can be entered here, and it can also be asked for when the spectrum is saved. If the **Ask on Start** box is checked, the description entered here will be presented as the default at the start of data acquisition. This feature is handy when processing a number of similar samples; the common part of the description can be entered here, and the unique descriptors can be added on start.

Sample Quantity

If the output activity is to be normalized to a volume or weight (or any other factor), the sample quantity can be entered here. The reporting units are entered, according to the sample type, on the System tab under **Analyze/Settings/Sample Type...**. This will normalize the activity and the report will be in normalized units. This normalization is in addition to any normalization done by the multiplier and divisor on the Analysis Options dialog (Section 5.5.1.1).

Collection Date and Time

If the decay correction is enabled (see the Sample tab under **Analyze/Settings/Sample Type...**, Section 5.5.1.1), the collection date and time are used in the correction formula.[9]

[9]If the collection date and time is before that of the spectrum acquisition, the spectrum will be activity-corrected back to the sample collection time. While this is the normal use of this input, if the collection date and time is after the acquisition time, the decay correction will be made forward in time.

5.2.2. Start

This initiates data collection in the selected Detector. Any warnings arising from problems detected at the hardware level will appear in a message box or on the Supplemental Information Line at the bottom of the display. The Detector can also be started with the **<Alt + 1>** accelerator, the **Start Acquisition** button on the Toolbar, or the **Start** command on the right-mouse-button menu. If the Detector is already started or if ScintiVision is in buffer mode, this entry is grayed.

5.2.3. Start/Save/Report

This function performs all three functions without user intervention. The **Start** is the same as the **Start** above, **Save** is the same as **File/Save** (using the filename in the **Acquire/Acquisition Settings...** dialog), and **Report** is the same as **Analyze/Entire spectrum in memory**.

5.2.4. Stop

Stop terminates data collection in the selected Detector. The display must be in Detector mode. If the Detector is not active, the entry is grayed. The Detector can also be stopped with the accelerator **<Alt+ 2>,** the **Stop Acquisition** button on the Toolbar, and the **Stop** command on the right-mouse-button menu.

5.2.5. Clear

Clear erases the Detector spectral data and the descriptors (e.g., real time, live time, start time) for the selected Detector. The presets are not altered. (This function might not operate on some types of Detectors when they are collecting data.) The data can also be cleared with **<Alt+ 3>**, the **Clear Spectrum** button on the Toolbar, or the **Clear** command on the right-mouse-button menu.

5.2.6. Copy to Buffer

The **Copy to Buffer** function transfers the data and descriptors (e.g., live time, real time), from the selected Detector to a buffer window. This function can also be performed with **<Alt + 5>** or the **Copy to Buffer** command on the right-mouse-button menu.

5.2.7. QA

This is explained in Chapter 8, “Quality Assurance.”

5.2.8. Download Spectra...

This command supports standalone MCBs such as Detective®-family instruments, trans-SPEC®, digiDART®, and DART®, and is used to download the spectra from the MCB to the computer disk. Note that downloading the spectra does not erase them from the MCB. The files are stored in the folder and spectrum file format defined on the Directories tab under **File/Settings...** (Section 5.1.1.4). They are named according to the format:

`sss iiiiiiii ddddddddd ttttttttt.ext`

where:

`sss` is the sequence number as shown on the digiDART spectrum list display or the storage sequence in the DART.

`iiiiiiii` is the ID string entered on the digiDART when the spectrum was saved and shown on the digiDART spectrum list display or the text string from the barcode reader in the DART.

`ddddddddd` is the date the spectrum was collected, as recorded in the MCB.

`ttttttttt` is the time the spectrum was collected, as recorded in the MCB.

`ext` is the extension for the file type selected.

If any **Ask on Save** options are set in the file settings dialog, they will be asked for each spectrum individually. Note that if you cancel an ask-on-save prompt for a particular spectrum, any remaining ask-on-save prompts for that spectrum are not displayed, and the spectrum is not saved to disk.

NOTE Before downloading, make sure the current conversion gain setting for this MCB (see the ADC tab under **Acquire/MCB Properties...**) is the same as or greater than the conversion gain of the stored spectra; otherwise, the downloaded spectra will be truncated at the current conversion gain setting. For example, if a digiDART was used to acquire 8k spectra in the field and the current conversion gain setting is 4k, only the first 4096 channels of data in each spectrum will be downloaded.

5.2.9. ZDT Display Select

This command is active only when the current Detector is a DSPEC Plus and one of the zero-dead-time (ZDT) modes has been enabled on the ADC tab under **Acquire/MCB Properties...**. When the DSPEC Plus is in a **ZDT** mode, two spectra are collected: either live-time

corrected (LTC) and ZDT; or uncertainty (ERR) and ZDT (see Fig. 68 and the discussion in Section 5.2.10.6).

The spectrum is labeled in the upper-right corner of the Full Spectrum View. When you choose **ZDT Display Select**, the ZDT spectrum is displayed, the **ZDT** label appears in the Full Spectrum View, and this command has a checkmark beside it on the menu. This function is duplicated by **<F3>**.

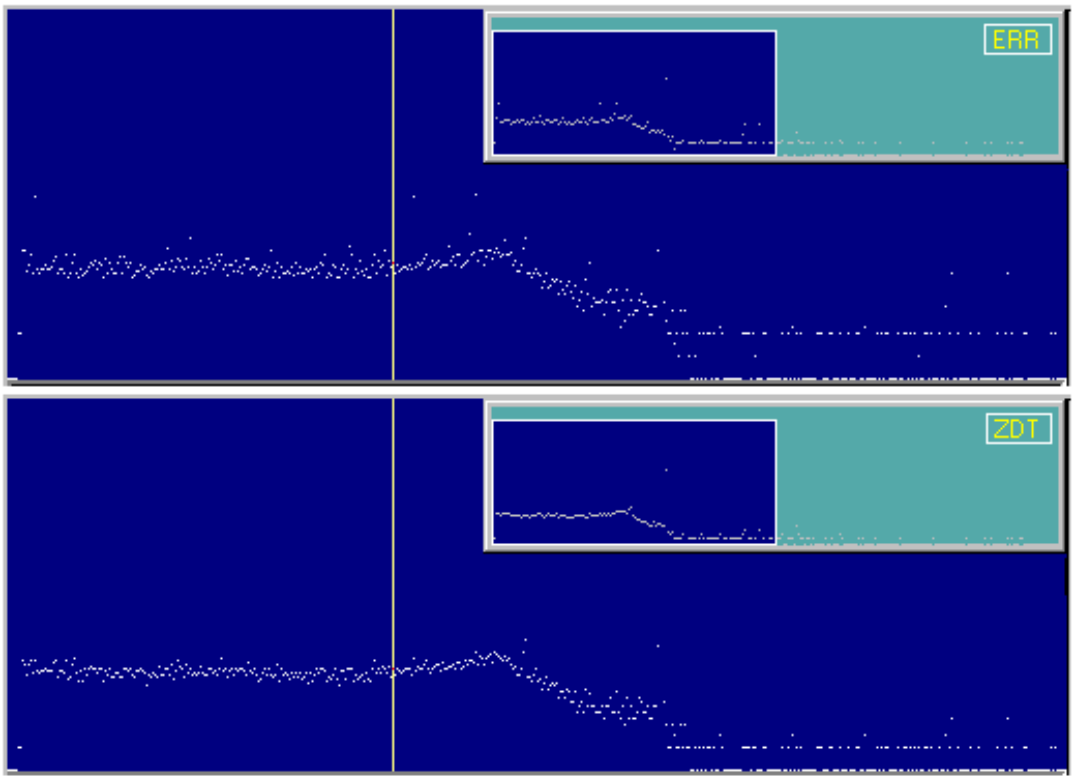


Fig. 68. Example of Uncertainty and ZDT Spectra Showing Labels in Full Spectrum View.

5.2.10. MCB Properties...

ORTEC CONNECTIONS-32 applications now use a uniform data-acquisition setup dialog called Properties. In ScintiVision, the Properties dialog opens when you select the **Acquire/MCB Properties...** command. The MCB properties for the DSPEC jr 2.0 and digiBASE are described here. ScintiVision will operate with any ORTEC CONNECTIONS-32 compliant MCB. To see the Properties dialogs for other CONNECTIONS-compliant MCBs, refer to the corresponding hardware manual or to the *MCB Properties Manual*.

Depending on the currently selected MCB, the Properties dialog displays several tabs of hardware controls including ADC setup parameters, acquisition presets, high-voltage controls, amplifier gain adjustments, gain and zero stabilizers, pole-zero and other shaping controls, and

access to the InSight™ Virtual Oscilloscope. In addition, the Status tab for certain MCBs monitors conditions such as alpha chamber pressure, detector status, charge remaining on batteries, and the number of spectra collected in remote mode. Find your Detector's setup section here or in the MCB properties manual, move from tab to tab and set your hardware parameters, then click on **Close**. Note that as you enter characters in the data-entry fields, the characters will be underlined until you move to another field or until 5 seconds have lapsed since a character was last entered. During the time the entry is underlined, no other program or PC on the network can modify this value.

If the Detector is locked (see Section 5.7.3), you must know the password before you can modify its MCB properties. To view a locked Detector's properties in read-only mode, click on **Cancel** when the Unlock Password dialog opens.

5.2.10.1. DSPEC jr 2.0

Amplifier

Figure 69 shows the Amplifier tab. This tab contains the controls for **Gain**, **Baseline Restore**, **Preamplifier Type**, **Input Polarity**, and **Optimize**.

NOTE Be sure that all of the controls on the tabs have been set *before* clicking the **Start Auto** (optimize) button. The changes you make on most property tabs *take place immediately*. There is no cancel or undo for these dialogs.

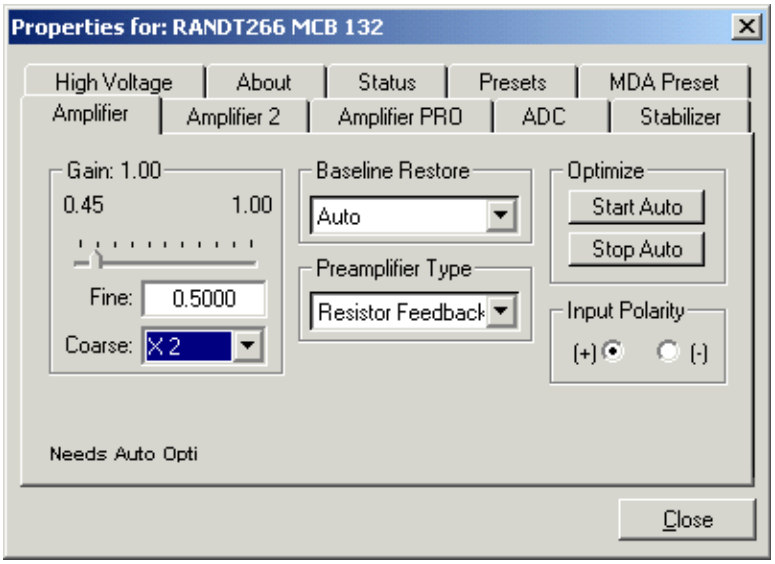


Fig. 69. DSPEC jr 2.0 Amplifier Tab.

Gain — Set the amplifier coarse gain by selecting from the **Coarse** droplist, then adjust the **Fine** gain with the horizontal slider bar or the edit box, in the range of 0.45 to 1.00. The resulting effective gain is shown at the top of the **Gain** section. The two controls used together cover the entire range of amplification from 0.45 to 32.

Input Polarity — These radio buttons select the preamplifier input signal polarity for the signal from the detector. Normally, GEM (p-type) detectors have a positive signal and GMX (n-type) have a negative signal.

Baseline Restore — This is used to return the baseline of the pulses to the true zero between incoming pulses. This improves the resolution by removing low frequency noise from dc shifts or mains power ac pickup. The baseline settings control the time constant of the circuit that returns the baseline to zero. There are three fixed choices (**Auto**,[10] **Fast**, and **Slow**). The fast setting is used for high count rates, the slow for low count rates. **Auto** adjusts the time constant as appropriate for the input count rate. The setting is saved in the DSPEC jr 2.0 even when the power is off. The time constant can be manually set on the InSight display (see Section 5.2.10.3).

You can view the time when the baseline restorer is active on the InSight display as a **Mark** region (see the discussion on Marks, p. 83). In the automatic mode, the current value is shown on the InSight sidebar (Fig. 87). For a low-count-rate system, the value will remain at about 90.

Preamplifier Type — Use the **Preamplifier Type** section to choose **Transistor Reset** or **Resistive Feedback** preamplifier operation. Your choice will depend on the preamplifier supplied with the germanium detector being used.

Optimize — The DSPEC jr 2.0 is equipped with both automatic pole-zero logic[11] and automatic flattop logic.[12] The **Start Auto** (optimize) button uses these features to automatically choose the best pole zero and flattop tilt settings. Note that if you selected **Transistor Reset** as the **Preamplifier Type** for this DSPEC jr 2.0, the optimize button does not perform the pole zero.

As with any system, the DSPEC jr 2.0 should be optimized any time the detector is replaced or if the flattop width is changed. For optimization to take place, the DSPEC jr 2.0 must be processing pulses. The detector should be connected in its final configuration before optimizing is started. There should be a radioactive source near the detector so that the count rate causes a dead time of ~5%. Dead time is displayed on the DSPEC jr 2.0 front panel and on the Status Sidebar during data acquisition.

Select either the **Resistive Feedback** or **Transistor Reset** option and click on **Start Auto**. The optimize command is sent to the DSPEC jr 2.0 at this time and, if the DSPEC jr 2.0 is able to start the operation, a series of short beeps sounds to indicate that optimization is in progress. When optimizing is complete, the beeping stops.

During optimization, pole zeroes are performed for several rise-time values and the DSPEC jr 2.0 is cycled through all the rise time values for the determination of the optimum tilt

[10]U.S. Patent 5,212,825.

[11]U.S. Patent 5,872,363.

[12]U.S. Patent 5,821,533.

values. As all of the values for all the combinations are maintained in the DSPEC jr 2.0, the optimize function does not need to be repeated for each possible rise time. The optimization can take from 1 to 10 minutes depending on count rate.

You should repeat the optimization if you change the flattop width.

The effect of optimization on the pulse can be seen in the InSight mode, on the Amplifier 2 tab. Note, however, that if the settings were close to proper adjustment before starting optimization, the pulse shape may not change enough for you to see. (In this situation, you also may not notice a change in the shape of the spectrum peaks.) The most visible effect of incorrect settings is high- or low-side peak tailing or poor resolution.

Amplifier 2

Figure 70 shows the Amplifier 2 tab, which accesses the advanced DSPEC jr 2.0 shaping controls including the InSight Virtual Oscilloscope mode.

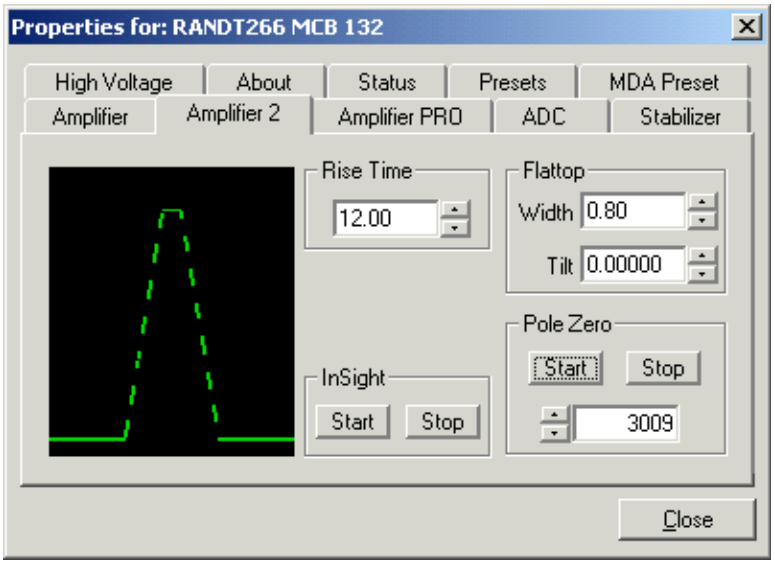


Fig. 70. DSPEC jr 2.0 Amplifier 2 Tab.

The many choices of **Rise Time** allow you to precisely control the tradeoff between resolution and throughput. The value of the rise time parameter in the DSPEC jr 2.0 is roughly equivalent to twice the integration time set on a conventional analog spectroscopy amplifier. Thus, a DSPEC jr 2.0 value of 12 corresponds to 6 in a conventional amplifier. Starting with the nominal value of 12.0, you should increase values of the rise time for better resolution for expected lower count rates, or when unusually high count rates are anticipated, reduce the rise time for higher throughput with somewhat worse resolution.

Use the up/down arrows to adjust the **Rise Time** within the range of 0.8 to 23.0 μs. After all the controls have been adjusted, return to the Amplifier tab and click on **Start Auto**. The most recent settings are saved in the DSPEC jr 2.0 firmware even when the power is turned off.

For the more advanced user, the InSight mode allows you to directly view all the parameters and adjust them interactively while collecting live data. To access the InSight mode, go to the **Insight** section on the Amplifier 2 tab and click on **Start**. The InSight mode is covered in Section 5.2.10.3.

The **Rise Time** value is for both the rise and fall times; thus, changing the rise time has the effect of spreading or narrowing the quasi-trapezoid symmetrically.

The **Flattop** controls adjust the top of the quasi-trapezoid. The **Width** adjusts the extent of the flattop (from 0.3 to 2.4 μs). The **Tilt** adjustment varies the "flatness" of this section slightly. The **Tilt** can be positive or negative. Choosing a positive value results in a flattop that slopes downward; choosing a negative value gives an upward slope. Alternatively, the optimize feature on the Amplifier tab can set the tilt value automatically. This automatic value is normally the best for resolution, but it can be changed on this dialog and in the InSight mode to accommodate particular throughput/resolution tradeoffs. The optimize feature also automatically adjusts the pole-zero setting.

The dead time per pulse is $(3 \times \textit{Rise Time}) + (2 \times \textit{Flattop Width})$.

In the **Pole Zero** section, the **Start** button performs a pole zero at the specified rise time and other shaping values. Unlike the optimize feature, it performs a pole zero for only the one rise time. The pole-zero **Stop** button aborts the pole zero, and is normally not used.

When you are satisfied with the settings, **Close** the Properties dialog and prepare to acquire data.

Once data acquisition is underway, the advanced user may wish to return to **MCB Properties...** and click on the **Insight** section's **Start** button to adjust the shaping parameters interactively with a "live" waveform showing the actual pulse shape, or just to verify that all is well.

Amplifier PRO

This tab (Fig. 71) contains the LFR filter control, which is discussed in detail in hardware manual. To enable **Low Frequency Rejector** mode, mark the checkbox. Unmark the checkbox to turn off the LFR filter.

NOTE You ***cannot*** optimize or pole-zero the DSPEC jr 2.0 while in LFR mode. The Optimize feature should be used with the LFR filter off. Subsequent measurements can then be taken with the LFR filter on.

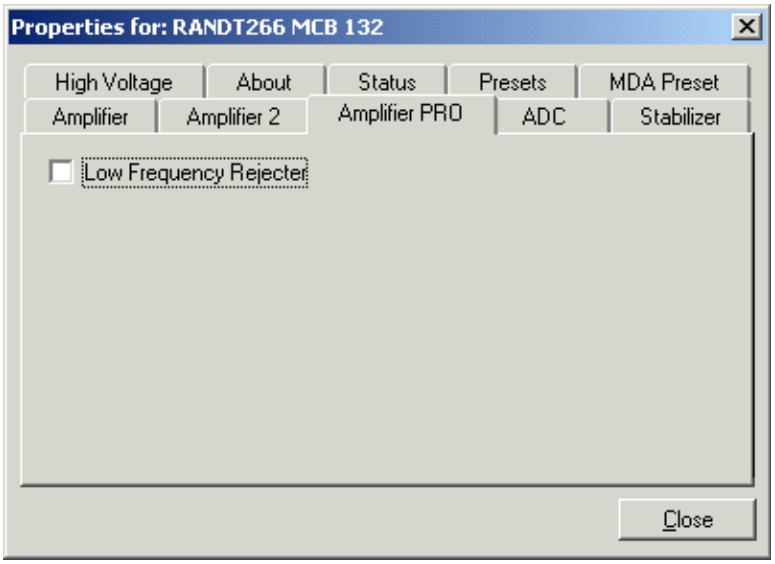


Fig. 71. DSPEC jr 2.0 ADC Tab.

ADC

This tab (Fig. 72) contains the **Gate**, **ZDT Mode**, **Conversion Gain**, **Lower Level Disc**riminator, and **Upper Level Disc**riminator controls. In addition, the current real time, live time, and count rate are monitored at the bottom of the dialog.

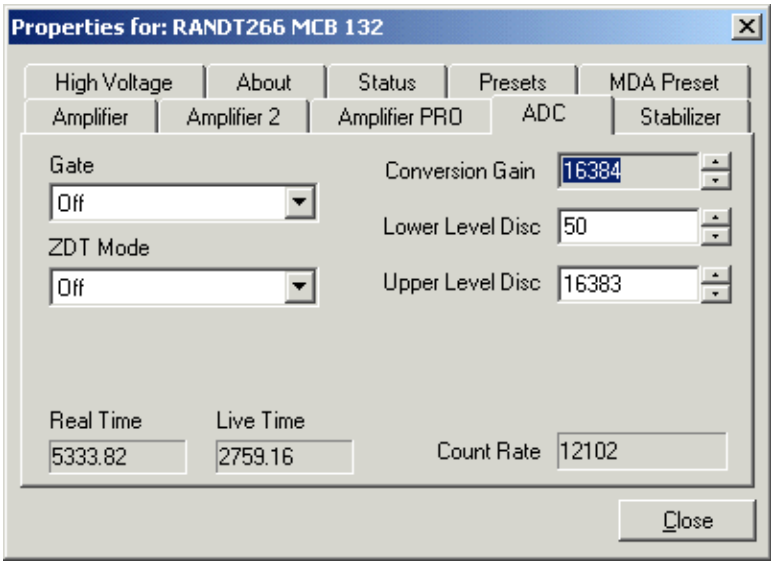


Fig. 72. DSPEC jr 2.0 ADC Tab.

Gate — The **Gate** control allows you to select a logic gating function. With this function **Off**, no gating is performed (that is, all detector signals are processed); with the function in **Coincidence**, a gating input signal *must be* present at the proper time for the conversion of the event; in **Anticoincidence**, the gating input signal *must not be* present for the conversion of the detector signal. The gating signal must occur prior to and extend 500 ns beyond peak detect (peak maximum).

ZDT Mode — Use this droplist to choose the **ZDT Mode** to be used for collecting the zero dead time (corrected) spectrum (see Section 5.2.10.6). The three modes are **Off** (LTC only), **NORM_CORR** (LTC and ZDT), and **CORR_ERR** (ERR and ZDT). If one of the ZDT modes is selected, both spectra are stored in the same spectrum (`.SPC`) file. If you do not need the ZDT spectrum, you should select **Off**.

In MAESTRO, the display can show either of the two spectra with the **Acquire/ZDT Display Select** command.

Conversion Gain — This control sets the maximum channel number in the spectrum. If set to 16384, the energy scale will be divided into 16384 channels. The conversion gain is entered in powers of 2 (e.g., 8192, 4096, 2048). The up/down arrow buttons step through the valid settings for the DSPEC jr 2.0.

Upper- and Lower-Level Discriminators — In the DSPEC jr 2.0, the lower- and upper-level discriminators are under computer control. The **Lower Level Disc**riminator sets the level of the lowest amplitude pulse that will be stored. This level establishes a lower-level cutoff by channel number for ADC conversions.

The **Upper Level Disc**riminator sets the level of the highest amplitude pulse that will be stored. This level establishes an upper-level cutoff by channel number for storage.

Stabilizer

The DSPEC jr 2.0 has both a gain stabilizer and a zero stabilizer.

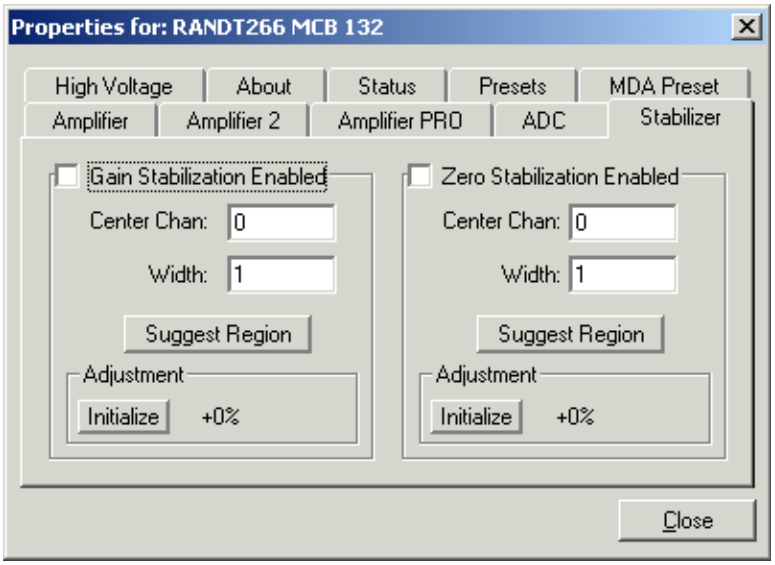


Fig. 73. DSPEC jr 2.0 Stabilizer Tab.

The Stabilizer tab (Fig. 73) shows the current values for the stabilizers. The value in each **Adjustment** section shows how much adjustment is currently applied. The **Initialize** buttons set the adjustment to 0. If the value approaches 90% or above, the amplifier gain should be adjusted so the stabilizer can continue to function — when the adjustment value reaches 100%, the stabilizer cannot make further corrections in that direction. The **Center Chan**nel and **Width** fields show the peak currently used for stabilization.

To enable the stabilizer, enter the **Center Chan**nel and **Width** values manually or click on the **Suggest Region** button. **Suggest Region** reads the position of the marker and inserts values into the fields. If the marker is in an ROI, the limits of the ROI are used. If the marker is not in an ROI, the center channel is the marker channel and the width is 3 times the FWHM at this energy. Now click on the appropriate **Enabled** checkbox to turn the stabilizer on. Until changed in this dialog, the stabilizer will stay enabled even if the power is turned off. When the stabilizer is enabled, the **Center Chan**nel and **Width** cannot be changed.

High Voltage

Figure 74 shows the High Voltage tab, which allows you to turn the high voltage on or off; set and monitor the voltage; and choose the **Shutdown** mode. The polarity is set in the DIM module.

The high voltage is overridden by the detector bias remote shutdown signal from the detector; high voltage cannot be enabled if the remote shutdown or overload signals prevent it. The **Overload** indicator means there is a bad connection in your system. The **Shutdown** indicator means that either the detector is warm or you have chosen the wrong shutdown mode.

Enter the detector high voltage in the **Target** field, click **On**, and monitor the voltage in the **Actual** field. Click the **Off** button to turn off the high voltage.

The shutdown can be ORTEC, TTL or SMART. The ORTEC mode is used for all ORTEC detectors except SMART-1 detectors. Use the SMART option for those detectors. Check with the detector manufacturer for other detectors. The TTL mode is used for most non-ORTEC detectors.

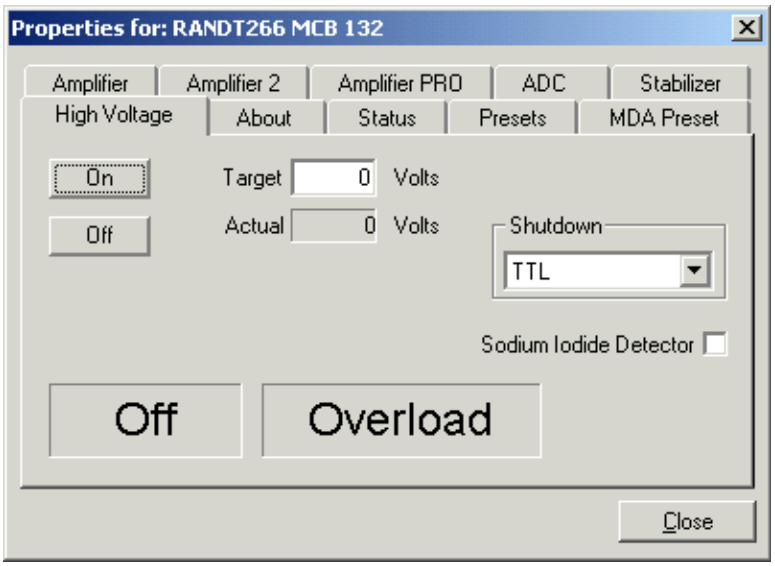


Fig. 74. DSPEC jr 2.0 High Voltage Tab.

The high voltage in the DSPEC jr 2.0 is supplied by the SMART-1 module or in a separate DIM. The recommended HV for SMART-1 is displayed on the dialog. For other detectors, see the detector manual or data sheet for the correct voltage. The polarity is determined by the DIM or SMART-1 module.

To use a **Sodium Iodide Detector**, mark the checkbox. This changes the gain and zero stabilizers to operate in a faster mode." For the DIM-296, the HV is controlled by the adjustment in the Model 296 and not here.

About

This tab (Fig. 75) displays hardware and firmware information about the currently selected DSPEC jr 2.0, as well as the data **Acquisition Start Time** and **Sample** description. In addition, the **Access** field shows whether the Detector is currently locked with a password (see the password discussion in the MAESTRO user manual), **Read/ Write** indicates that the Detector is unlocked; **Read Only** means it is locked.

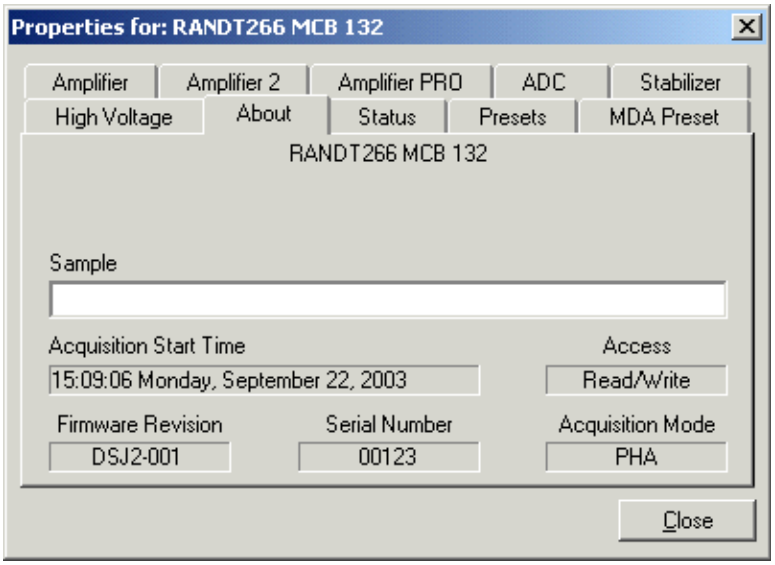


Fig. 75. DSPEC jr 2.0 About Tab.

Status

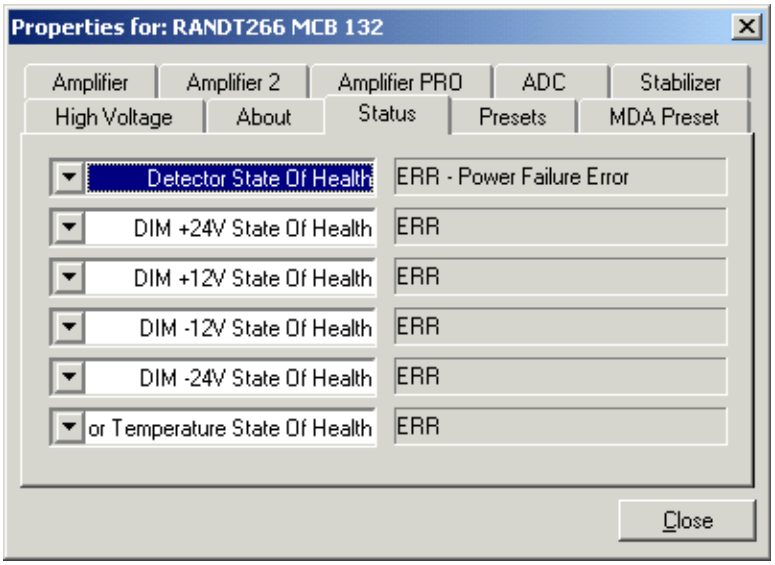


Fig. 76. DSPEC jr 2.0 Status Tab.

Figure 76 shows the Status tab. There are 21 values monitored at all times. You can select any six of these to be displayed simultaneously on the Status tab. You would normally pick the six that are most important to you. The values you select can be changed at any time, so you can view any of them as needed. Two types of values are presented: **OK** or **ERR**, and numeric value. The state-of-health (SOH) are all **OK** or **ERR**. If the state is **OK**, the parameter stayed within the set limits during the spectrum acquisition. If the parameter varied from the nominal value by more than the allowed limit, the **ERR** is set until cleared by the program. The numeric values are displayed in the units reported by the DSPEC jr 2.0. **Security**, **Detector temperature**, and **Live detector temperature** are available only for SMART-1 detectors. For non-SMART-1 detectors, they show **N/A**.

The parameters displayed are:

Detector State of Health

This is OK if all the SOH are OK and ERR if any one is ERR.

DIM +24V State of Health

This is OK if the +24 volt supply in the DIM has stayed within 200 mV of +24 volts since the last time the SOH was cleared.

DIM +12V State of Health

This is OK if the +12 volt supply in the DIM has stayed within 200 mV of +12 volts since the last time the SOH was cleared.

DIM -12V State of Health

This is OK if the −12 volt supply in the DIM has stayed within 200 mV of −12 volts since the last time the SOH was cleared.

DIM -24V State of Health

This is OK if the −24 volt supply in the DIM has stayed within 200 mV of −24 volts since the last time the SOH was cleared.

Temperature State of Health

This is OK if the detector temperature has stayed below the high temperature limit set in the detector since the last time the SOH was cleared. This is available only for SMART-1 detectors.

High Voltage State of Health

This is OK if the HV supply in the DIM has stayed within 200 V of specified bias voltage since the last time the SOH was cleared.

Shutdown State of Health

This is OK if the detector shutdown has not activated since the last time the SOH was cleared.

Preamplifier overload State of Health

This is OK if the preamplifier overload has not activated since the last time the SOH was cleared.

Security State of Health

This is OK if the security test was passed at the end of the last spectrum acquisition. This is available only for SMART-1 detectors.

Power State of Health

This is OK if the power to the DIM was constant during the last spectrum acquisition.

+24 volts

This is the current value of the +24 volt supply in the DIM as delivered to the detector.

+12 volts

This is the current value of the +12 volt supply in the DIM as delivered to the detector.

−12 volts

This is the current value of the -12 volt supply in the DIM as delivered to the detector.

−24 volts

This is the current value of the -24 volt supply in the DIM as delivered to the detector.

High Voltage

This is the current value of the high voltage bias supply in the DIM as delivered to the detector.

Detector temperature

This is the detector temperature at the time the current spectrum acquisition stopped. This is available only for SMART-1 detectors.

Live detector temperature

This is the detector temperature at the current time. This is available only for SMART-1 detectors.

Battery voltage

This is not used in the DSPEC jr 2.0.

Battery % full

This is not used in the DSPEC jr 2.0.

Battery time remaining

This is not used in the DSPEC jr 2.0.

Presets

Figure 77 shows the Presets tab. MDA presets are shown on a separate tab.

The presets can only be set on a Detector that is not acquiring data (during acquisition the preset field backgrounds are gray indicating that they are inactive). You can use any or all of the presets at one time. To disable a preset, enter a value of zero. If you disable all of the presets, data acquisition will continue until manually stopped.

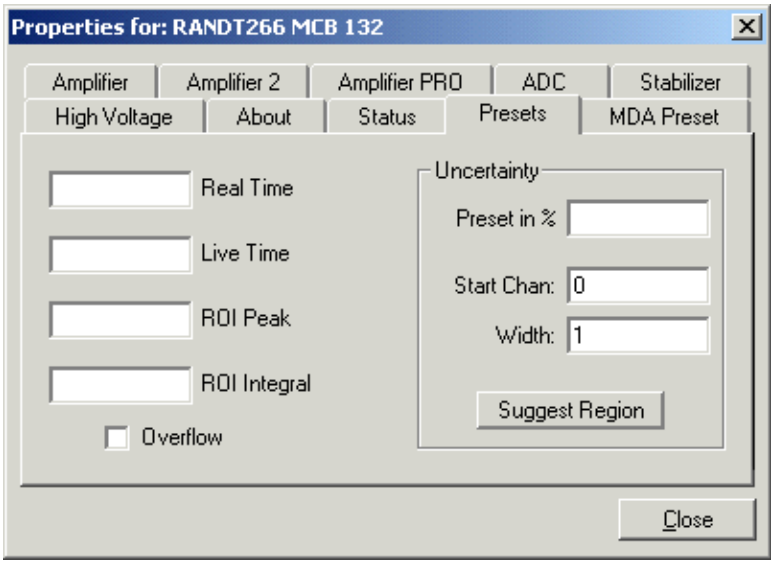


Fig. 77. DSPEC jr 2.0 Presets Tab.

When more than one preset is enabled (set to a non-zero value), the first condition met during the acquisition causes the Detector to stop. This can be useful when you are analyzing samples of widely varying activity and do not know the general activity before counting. For example, the **Live Time** preset can be set so that sufficient counts can be obtained for proper calculation of the activity in the sample with the least activity. But if the sample contains a large amount of this or another nuclide, the dead time could be high, resulting in a long counting time for the sample. If you set the **ROI Peak** preset in addition to the **Live Time** preset, the low-level samples will be counted to the desired fixed live

time while the very active samples will be counted for the ROI peak count. In this circumstance, the **ROI Peak** preset can be viewed as a "safety valve."

The values of all presets for the currently selected Detector are shown on the Status Sidebar. These values do not change as new values are entered on the Presets tab; the changes take place only when you **Close** the Properties dialog.

Enter the **Real Time** and **Live Time** presets in units of seconds and fractions of a second. These values are stored internally with a resolution of 20 milliseconds (ms) since the Detector clock increments by 20 ms. *Real time* means elapsed time or clock time. *Live time* refers to the amount of time that the Detector is available to accept another pulse (i.e., is not busy), and is equal to the real time minus the *dead time* (the time the Detector is not available).

Enter the **ROI Peak** count preset value in counts. With this preset condition, the Detector stops counting when any ROI channel reaches this value unless there are no ROIs marked in the Detector, in which case that Detector continues counting until the count is manually stopped.

Enter the **ROI Integral** preset value in counts. With this preset condition, the Detector stops counting when the sum of all counts in all channels for this Detector marked with an ROI reaches this value. This has no function if no ROIs are marked in the Detector.

The **Uncertainty** preset stops acquisition when the statistical or counting uncertainty of a user-selected net peak reaches the value you have entered. Enter the **Preset in %** value as percent uncertainty at 1 sigma of the net peak area. The range is from 99% to 0.1% in 0.1% steps. You have complete control over the selected peak region. The region must be at least 7 channels wide with 3 channels of background on each side of the peak. As the uncertainty is calculated approximately every 30 seconds, the uncertainty achieved for a high count-rate sample may be lower than the preset value.

Use the **Start Chan**nel and **Width** fields to enter the channel limits directly, or click on **Suggest Region**. If the marker is positioned in an ROI around the peak of interest, **Suggest Region** reads the limits of the ROI with the marker and display those limits in the **Start Chan** and **Width** fields. The ROI can be cleared after the preset is entered without affecting the uncertainty calculation. If the marker is not positioned in an ROI, the start channel is 1.5 times the FWHM below the marker channel and the width is 3 times the FWHM.

The net peak area and statistical uncertainty are calculated in the same manner as for the MAESTRO **Peak Info** command.

Marking the **Overflow** checkbox terminates acquisition when data in any channel exceeds $2^{31}-1$ (over 2×10^{9}) counts.

MDA Preset

The MDA preset (Fig. 78) can monitor up to 20 nuclides at one time, and stops data collection when the values of the *minimum detectable activity* (MDA) for all of the user-specified MDA nuclides reach the needed value. The MDA preset is implemented in the hardware. The formula for calculating the MDA can be generally represented as follows:

$$MDA = \frac{a + \sqrt{b + c * Counts}}{Live\ time * (Eff * Yield)}$$

The coefficients *a*, *b*, and *c* are determined by the MDA formula to be used. The *Eff* (detector efficiency) is determined from external programs. The *Yield* (branching ratio) is read from the working library using the nuclide and energy specified. The **MDA** value is the one you have entered in the dialog. *Counts* is the gross counts in the specified region and *Live time* is the live time. The *MDA* value is calculated in the MCB given the values *a*, *b*, *c*, *Live time*, and *Yield*. The calculated value is compared with the **MDA** value on the dialog and when it is lower, acquisition is stopped.

Coefficients A, **B**, and **C** can be entered as numbers for the MDA calculation desired.

Select the **Nuclide** and **Energy** from the droplists. The **Nuclide** list contains all the nuclides in the working library. The **Energy** list shows all the gamma-ray energies for the selected nuclide in the library.

The **MDA** field is labeled **Correction** because MAESTRO does not use efficiency. In this case, the *Eff* value is set to 1.0. The *Yield* value is taken from the library. If the **Correction** value entered is the actual MDA times the efficiency (known from other sources), the MDA preset will function normally.

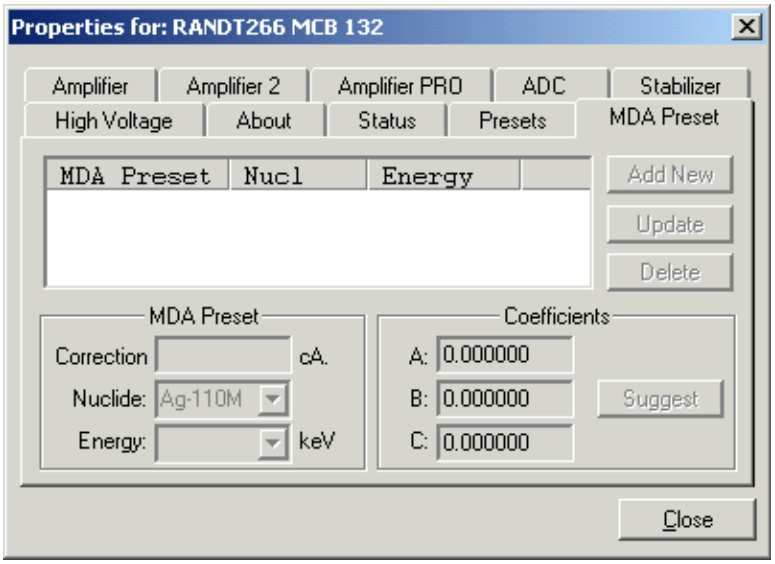


Fig. 78. DSPEC jr 2.0 MDA Preset Tab.

5.2.10.2. digiBASE

Amplifier

Figure 79 shows the Amplifier tab. This tab contains the controls for **Gain** and **Shaping Time**.

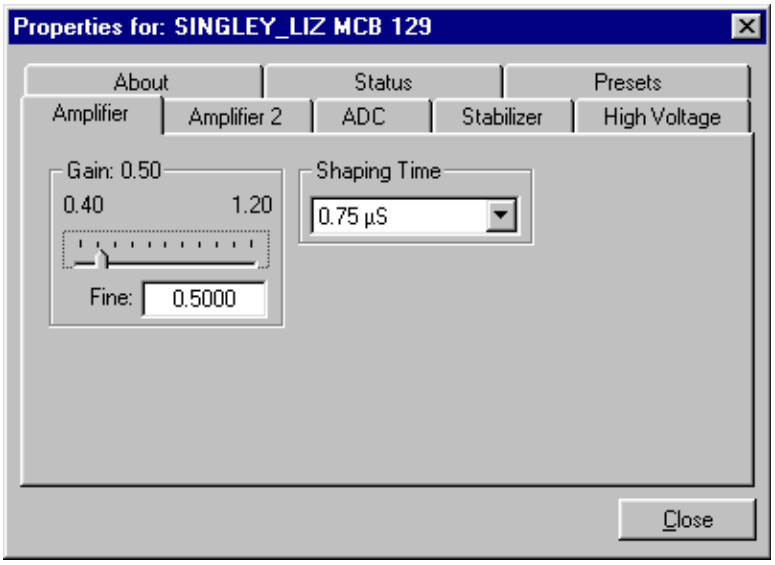


Fig. 79. digiBASE Amplifier Tab.

The amplifier coarse gain is set to 1, 3, or 9 by changing a jumper setting (see the digiBASE user manual). Once the coarse gain is set, adjust the **Fine** gain with the horizontal slider bar or the edit box, in the range of 0.4 to 1.2. The resulting effective gain is shown at the top of the **Gain** section. The two controls used together cover the entire range of amplification from 0.4 to 10.8.

In almost all cases, the default **Shaping Time**, 0.75 µs, is the preferred setting. However, the digiBASE supports shaping times from 0.75 µs to 2 µs in steps of 0.25 µs.

Amplifier 2

Figure 80 shows the Amplifier 2 tab, which accesses the InSight™ Virtual Oscilloscope mode. For the more advanced user, the InSight mode allows you to directly the digiBASE's advanced shaping parameters and adjust them interactively while collecting live data. To access the InSight mode, click on **Start**, then refer to the discussion in Section 5.2.10.3.

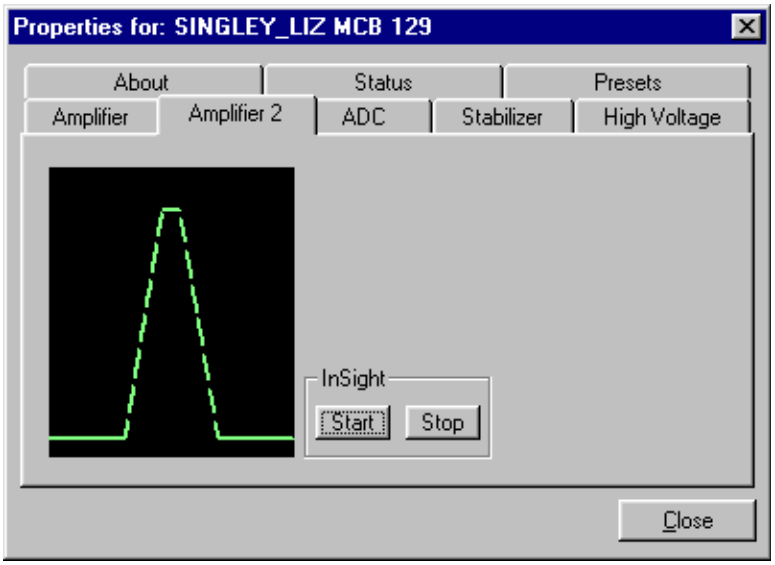


Fig. 80. digiBASE Amplifier 2 Tab.

When you are satisfied with the settings, **Close** the Properties dialog and prepare to acquire data. Once data acquisition is underway, the advanced user might wish to return to this tab and switch to the

Insight mode to adjust the shaping parameters interactively with a “live” waveform showing the actual pulse shape, or just to verify that all is well.

ADC

This tab (Fig. 81) contains the **Gate**, **Lower Level Disc**riminator, and **Upper Level Disc**riminator controls. In addition, the current real time and live time are monitored at the bottom of the dialog.

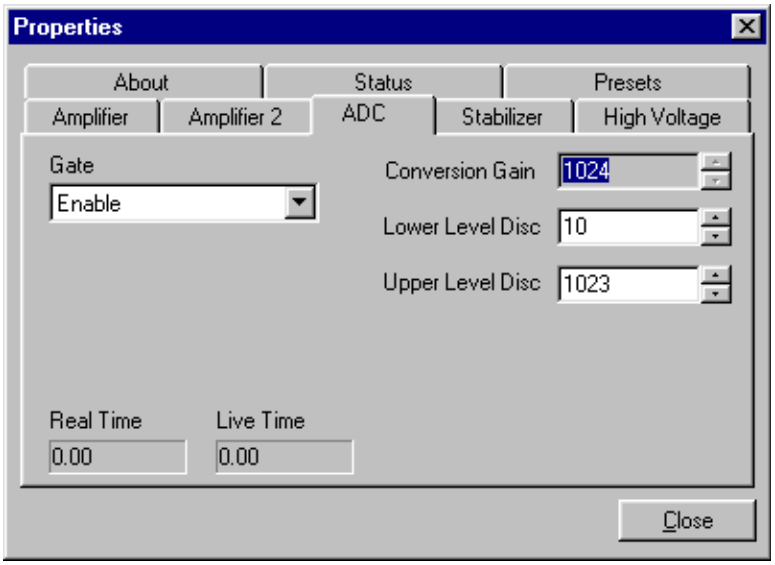


Fig. 81. digiBASE ADC Tab.

The **Gate** control allows you to select a logic gating function. With this function **Off**, no gating is performed (that is, all detector signals are processed).

When the **Gate** is set to **Enable**, if the ENABLE INPUT is low (<0.8V), real time, live time, and data acquisition are stopped. When the ENABLE INPUT is left open or forced high (>2.0V), real time, live time, and data acquisition are enabled.

If set to **Coincidence**, when the ENABLE INPUT is low, real time and live time operate normally, but no counts are stored in memory. If the ENABLE INPUT is high, normal acquisition occurs.

If set to **Event**, rising edges are counted by a 32-bit event counter. The contents of this counter can be monitored in the **Enable Counter** field on the Status tab (Section 5.2.10.2). The input impedance is 5 kΩ to +3.3V, protected to ±10 V.

The digiBASE operates at a **Conversion Gain** of 1024 only.

The **Lower Level Disc**riminator sets the level of the lowest amplitude pulse that will be stored. This level establishes a lower-level cutoff by channel number for ADC conversions.

The **Upper Level Disc**riminator sets the level of the highest amplitude pulse that will be stored. This level establishes an upper-level cutoff by channel number for storage.

Stabilizer

The digiBASE has both a gain stabilizer and a zero stabilizer; their operation is discussed in more detail in Sections 5.2.10.4 and 5.2.10.5.

The Stabilizer tab (Fig. 82) shows the current values for the stabilizers. The value in each **Adjustment** section shows how much adjustment is currently applied. The **Initialize** buttons set the adjustment to 0. If the value approaches 90% or above, the amplifier gain should be adjusted so the stabilizer can continue to function — when the adjustment value reaches 100%, the stabilizer cannot make further corrections in that direction. The **Center Chan**nel and **Width** fields show the peak currently used for stabilization.

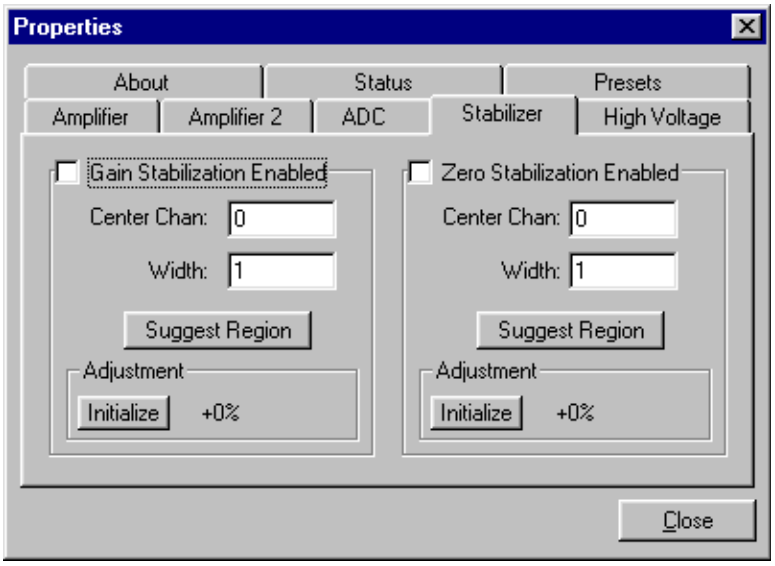


Fig. 82. digiBASE Stabilizer Tab.

To enable the stabilizer, enter the **Center Chan**nel and **Width** values manually or click on the **Suggest Region** button. **Suggest Region** reads the position of the marker and inserts values into the fields. If the marker is in an ROI, the limits of the ROI are used. If the marker is not in an ROI, the center channel is the marker channel and the width is 3 times the FWHM at this energy. Now click on the appropriate **Enabled** checkbox to turn the stabilizer on. Until changed in this dialog, the stabilizer will stay enabled even if the power is turned off. When the stabilizer is enabled, the **Center Chan**nel and **Width** cannot be changed.

High Voltage

Figure 83 shows the High Voltage tab, which allows you to turn the high voltage on or off; and set and monitor the voltage. Enter the detector high voltage in the **Target** field, click **On**, and monitor the voltage in the **Actual** field. Click the **Off** button to turn off the high voltage.

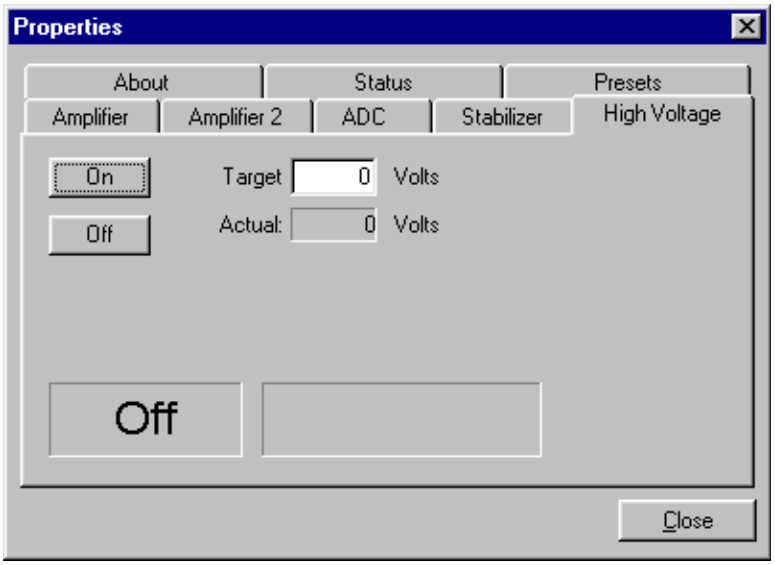


Fig. 83. digiBASE High Voltage Tab.

About

This tab (Fig. 84) displays hardware and firmware information about the currently selected DSPEC Plus as well as the data **Acquisition Start Time** and **Sample** description. In addition, the **Access** field shows whether the Detector is currently locked with a password (see Section 5.7.3), **Read/ Write** indicates that the Detector is unlocked; **Read Only** means it is locked.

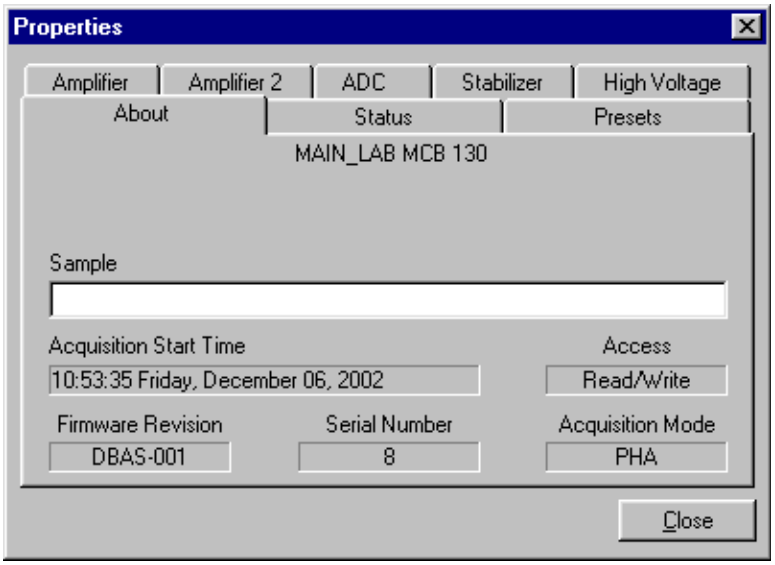


Fig. 84. digiBASE About Tab.

Status

Figure 85 shows the Status tab. The **Aux0** and **Aux1** counters are reserved for future use. The **Enable Counter** functions when the **Gate** function on the ADC tab is set to **Event** and the digiBASE is actively acquiring data in a spectrum. Under these conditions, the **Enable Counter** accrues the number of events at the ENABLE INPUT since the **Start** command was issued. To clear this counter, click on the **Clear Spectrum** button on the toolbar or issue **Acquire/ Clear**.

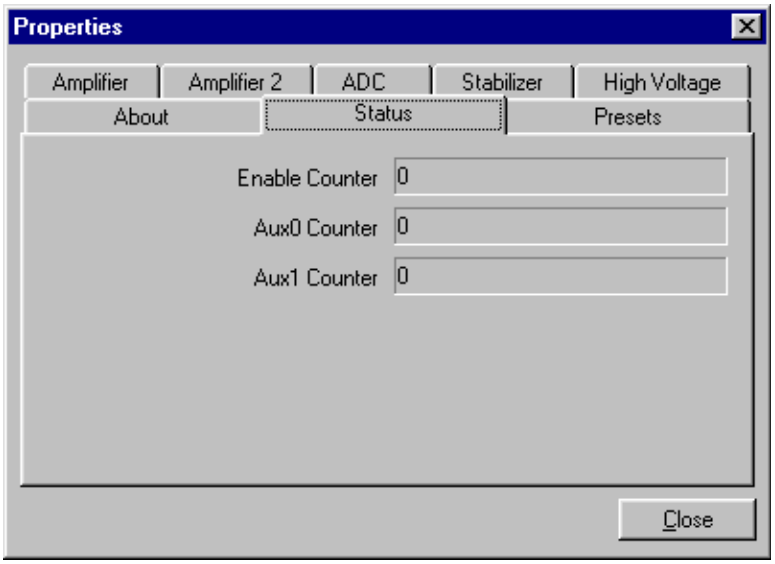


Fig. 85. digiBASE Status Tab.

Presets

Figure 86 shows the Presets tab. The presets can only be set on a Detector that is not acquiring data (during acquisition the preset field backgrounds are gray indicating that they are inactive). You can use either or both presets at one time. To disable a preset, enter a value of zero. If you disable both presets, data acquisition will continue until manually stopped.

When more than one preset is enabled (set to a non-zero value), the first condition met during the acquisition causes the Detector to stop. This can be useful when you are analyzing samples of widely varying activity and do not know the general activity before counting.

The values of all presets for the currently selected Detector are shown on the Status Sidebar. These values do not change as new values are entered on the Presets tab; the changes take place only when you **Close** the Properties dialog.

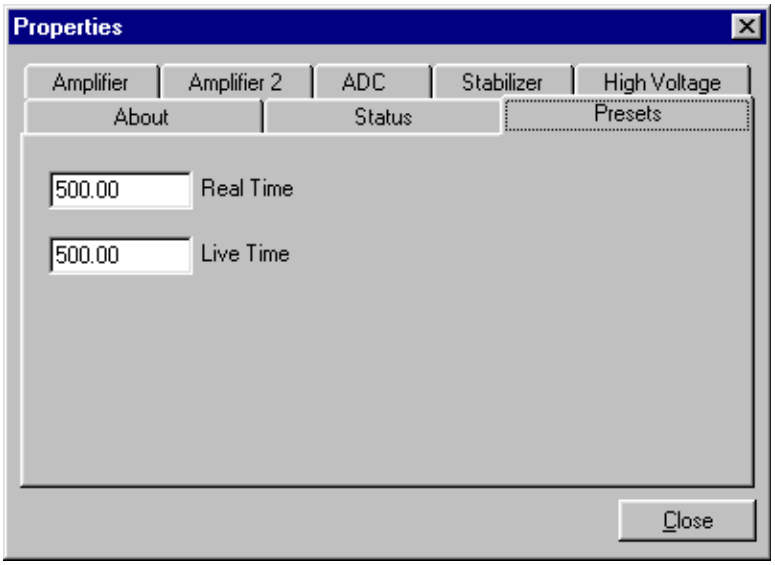


Fig. 86. digiBASE: The Presets Tab.

Enter the **Real Time** and **Live Time** presets in units of seconds and fractions of a second. These values are stored internally with a resolution of 20 milliseconds (ms) since the Detector clock

increments by 20 ms. *Real time* means elapsed time or clock time. *Live time* refers to the amount of time that the Detector is available to accept another pulse (i.e., is not busy), and is equal to the real time minus the *dead time* (the time the Detector is not available).

5.2.10.3. InSight Mode

The **InSight** display (Fig. 87) shows the actual sampled waveform in the digital processing units on a reference graticule. The Properties dialog remains active and can be used to change settings while viewing the pulses.

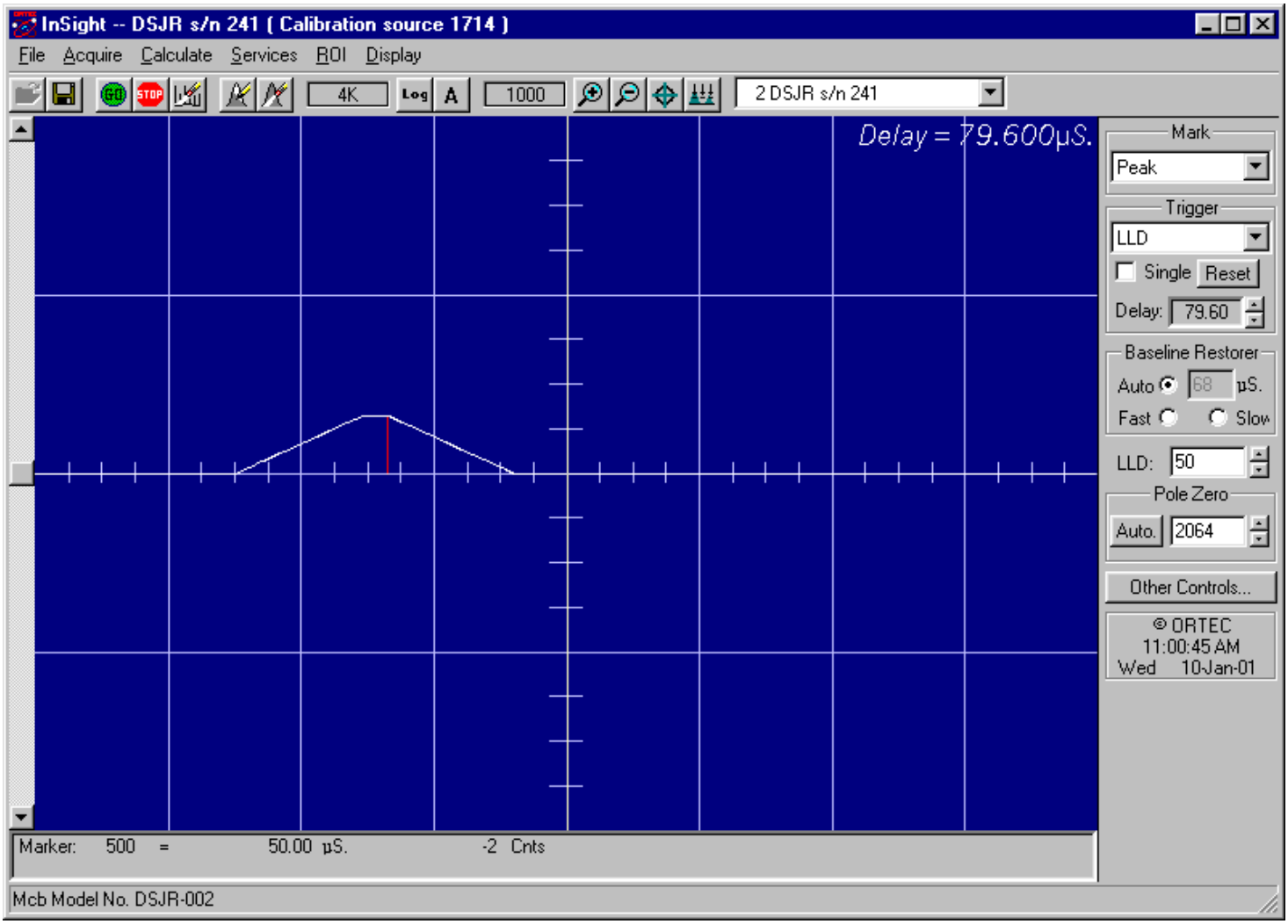


Fig. 87. The InSight Virtual Oscilloscope Mode.

As none of the traditional analog signals are available in digital MCBs, this mode is the only way to display the equivalent amplifier output pulse. Note that at the bottom of the window the marker channel is displayed in units of time.

To exit the InSight mode and return to the PHA display, press **<Esc>** or go to the **Insight** section on the Amplifier 2 tab and click on the **Stop** button on the toolbar (or **Acquire/Stop**). The PHA mode is set to STOP when in the InSight mode.

The Status Sidebar changes from the PHA mode controls to the InSight controls for adjusting the peak display (Fig. 87) On the left is a vertical scrollbar for adjusting the vertical offset of the waveform. The value of the offset is shown on the display. Double-clicking the mouse in the scrollbar will set the vertical offset to the vertical value of the channel at the marker position. This is to conveniently zoom in on a particular part of the waveform (such as the tail for pole-zeroing).

In the **Auto** trigger mode, the display is updated every time a new pulse exceeds the trigger level. To keep a single pulse displayed, select **Single**. Click on **Reset** to refresh the display to see the next pulse. There will usually be one or two pulses in the "pipeline" that will be displayed before any change entered will be seen. If the trigger is turned off, the display will be redrawn periodically, even if no pulse is there.

The **Delay** setting is the time delay between the pulse shown on the display and the trigger level crossing. The value of the time delay is shown on the display.

Just as for the PHA mode display, the vertical scale can be adjusted with the vertical adjustments. The display can be set to **Log** mode, but the peak shapes do not have a familiar shape in this display. The **Auto** mode will adjust the vertical scale for each pulse. The pulse is shown before the amplifier gain has been applied, so the relation between channel number and pulse height is not fixed.

The horizontal scale extends from 16 to 256 channels. The display is expanded around the marker position which means that in some cases the peak will disappear from the display when it is expanded.

The display can be switched from the current MCB to another Detector or the buffer. The other Detector will be shown in its most recent mode (PHA or InSight). The buffer will always be shown in PHA mode. When you return to the current MCB, the display will return to the InSight mode. This also holds true if you exit ScintiVision while in InSight mode; on next startup, this MCB will still be in InSight mode.

The display can include a **Mark** to indicate one of the other signals shown in Fig. 88. The Mark is a solid-color region displayed similarly to that of an ROI in the spectrum. This Mark can be used to set the timing for the gate pulse. It can also be used to set the shaping times and flattop parameters to get the best performance.

For example, suppose it is necessary to get the best resolution at the highest throughput possible. By viewing the pulses and the pileup reject marker, the rise time can be increased or decreased to obtain a minimum of pileup reject pulses.

Fig. 88. Mark Display Selection.

Mark Types

For the **Mark,** choose either “points” or “filled” (to the zero line) display. This is controlled by the selection in the **Display/Preferences** menu item. That choice does not affect the PHA mode choice. The colors are the same as for the PHA mode.

None No channels are marked in the display.

PileUpReject The region marked indicates when the PUR circuit has detected pileup and is rejecting the marked pulses.

NegBLDisc This shows when the negative baseline discriminator has been triggered. Typically this signal only marks the TRP reset pulse. The signal is used internally in the live-time correction, baseline restoration, and pile-up rejection circuits.

BaseLineR This shows when the baseline restorer is actively restoring the baseline.

PosBLDisc This shows when the positive baseline discriminator has been triggered. The signal is used internally in the live-time correction, baseline restoration, and pile-up rejection circuits.

Busy When the busy signal is active, **Busy** shows in the **Mark** box. It represents the dead time.

Gate This shows when the gate signal is present on the gate input connector. If the **Gate** mode on the ADC tab is set to **Off**, then all regions are marked. If the mode is set to **Coincidence**, then the marked region must overlap the pulse peak (that is, must start before the beginning of the flattop and stop after the end of the flattop) for the pulse to be counted. If the mode is set to **Anticoincidence**, then the marked region will show the pulses that are accepted. That is, the rejected peaks will not be marked. Simply put, in all modes the accepted peaks are marked.

Peak This is the peak detect pulse. It indicates when the peak detect circuit has detected a valid pulse. The Mark occurs about 1.5 μs after the pulse maximum on the display.

On the lower right of the InSight display are the shaping parameter controls. The controls are split into two groups, and the **other controls...** button switches between them.

One group includes **Rise Time**, **Flattop**, **Tilt**, and the **Optimize** button. The **Rise Time** value is for both the rise and fall times; thus, changing the rise time has the effect of spreading or narrowing the quasi-trapezoid symmetrically.

The **Flattop** controls adjust the top of the quasi-trapezoid. The **Width** adjusts the extent of the flattop (this varies by instrument). The **Tilt** adjustment varies the "flatness" of this section slightly. The **Tilt** can be positive or negative. Choosing a positive value results in a flattop that slopes downward; choosing a negative value gives an upward slope. Alternatively, **Optimize** can set the tilt value automatically. This value is normally the best for resolution, but it can be changed on this dialog and in the InSight mode to accommodate particular throughput/resolution tradeoffs. The **Optimize** button also automatically adjusts the pole-zero setting.

5.2.10.4. Gain Stabilization

You can control the gain stabilizer on Detectors so equipped. The gain stabilizer requires a peak in the spectrum to monitor the changes in the gain of the system amplifier. The gain stabilizer controls the amplification factor of a separate amplifier so that the peak will be maintained in its original position. The input pulse-height-to-channel-number relationship is:

$$\textit{Channel number} = \textit{Intercept} + \textit{Gain} * \textit{pulse height}$$

where:

Intercept = The channel number of the zero-height input pulse
Gain = The relation between pulse height and channel number (slope of the curve)

Changes in either the intercept or gain can affect the positions of all the peaks in the spectrum. When used with the zero stabilizer, both the zero intercept and the gain (slope) will be monitored to keep all the peaks in the spectrum stabilized. The zero stabilization and gain stabilization are separate functions in the MCB, but both will affect the position of the peaks in the spectrum.

The stabilization operates by keeping a peak centered in an ROI you have defined. The ROI should be made symmetrically about the center of a peak with reasonably good count rate in the higher channels of the spectrum. The ROI should be about twice the FWHM of the peak. If the

region is too large, counts not in the peak will have an effect on the stabilization. The ROI can be cleared after the **Peak** command so that peak count preset can be used on another peak.

The coarse and fine gains should be set to the desired values, both stabilizers initialized, and the pole zero triggered before setting either stabilization peak. For example, on the 92X this is done with the **Acquire/MCB Properties...** dialog; on the Model 919 it is done externally.

The **Initialize** dialog button sets the gain on the stabilization amplifier to its midpoint (that is, halfway between minimum gain and maximum gain). This should be done before selecting the ROI for the peak because the initialization might move the peak in the spectrum, and because it ensures that the maximum range is available for the stabilization process. If the peak is moved by this command, use the amplifier fine gain control (<**Alt** + −> or <**Alt** + +>) to move the peak to the desired channel.

When starting a new system, the zero-initialize command should also be given before starting the gain stabilization.

The **Suggest** button is used to set the peak center and peak width of the peak area used by the stabilizer. Before selecting this command, the ROI must be marked and the marker put in the region to be used. When operating, the peak will be centered in the ROI. After the region has been recorded, the stabilization is turned on. If the stabilization is turned on when this command is executed, the old stabilization region is replaced by the new peak defined by the marker, and stabilization continues using the new peak.

The **Gain Stabilizer Enabled** checkbox enables or disables the gain stabilization. It can only be turned on after the **Suggest** button has been used to select a working peak.

5.2.10.5. Zero Stabilization

The **Zero Stabilizer** function enables you to control the zero-level (or offset) stabilizer on Detectors so equipped. The zero-level stabilizer uses a peak in the spectrum to monitor the changes in the zero level of the system amplifier. The zero stabilizer controls the offset bias level so the peak will be maintained in its original position. The input pulse-height-to-channel-number relationship is:

$$Channel\ number = Intercept + Gain * pulse\ height$$

where:

Intercept = The channel number of the zero-height input pulse
Gain = The relation between pulse height and channel number (slope of the curve)

Changes in either the zero intercept or gain can affect the positions of all the peaks in the spectrum. When used with the gain stabilizer, both the zero intercept and the gain (slope) are monitored to keep all the peaks in the spectrum stabilized. The zero stabilization and gain stabilization are separate functions in the MCB but both will affect the position of the peaks in the spectrum.

The stabilization operates by keeping a peak centered in an ROI you have defined. The ROI should be set symmetrically about the center of a peak with reasonably good count rate in the lower channels of the spectrum. The ROI should be about twice the FWHM of the peak. If the region is too large, counts not in the peak will have an effect on the stabilization. The ROI can be cleared after the PEAK command so that peak count preset can be used on another peak.

The zero stabilization dialog **Initialize** button sets the zero offset to its midpoint (that is, halfway between minimum offset and maximum offset). This should be done before selecting the ROI for the peak because the initialization might move the peak in the spectrum, and because it ensures that the maximum range is available for the stabilization process.

The **Suggest** button is used to set the peak center and peak width of the peak area used by the stabilizer. Before selecting this command, the ROI must be marked and the marker put in the region to be used. When operating, the peak will be centered in the ROI. After the region has been recorded, the stabilization is turned on. If the stabilization is turned on when this command is executed, the old stabilization region is replaced by the new peak defined by the marker, and stabilization continues using the new peak.

The **Zero Stabilizer Enabled** checkbox enables or disables the zero stabilization. It can only be turned on after the **Suggest** button has been used to select a working peak.

5.2.10.6. ZDT (Zero Dead Time) Mode

An *extended live-time clock* increases the collection time (real time) of the acquisition to correct for input pulse train losses incurred during acquisition due to system dead time. This corrected time value, known as the live time, is then used to determine the net peak count rates necessary to determine nuclide activities.

As an example, consider the case where the spectrometry amplifier and ADC are 60% dead during the acquisition. the elapsed real time will be:

$$Real\ Time = \left(\frac{Live\ Time}{1 - 0.60} \right)$$

$$= \left(\frac{Live\ Time \times 100\%}{100\% - \%\ Dead\ Time} \right)$$

If the *N* counts in the gamma-ray peak in the spectrum are divided by the elapsed live time, the resulting counting rate, $N / Live\ Time$, is now corrected for dead-time losses. The standard deviation in that counting rate is $\sqrt{N} / Live\ Time$.

Unfortunately, extending the counting time to make up for losses due to system-busy results in an incorrect result *if the gamma-ray flux is changing as a function of time*. If an isotope with a very short half-life is placed in front of the detector, the spectrometer might start out with a very high dead time, but the isotope will decay during the count and the dead time will be zero by the end of the count. If the spectrometer extends the counting time to make up for the lost counts, it will no longer be counting the same source as when the losses occurred. As a result, the number of counts in the peak will not be correct.

When a DSPEC Pro or other supported ORTEC MCB operates in ZDT[13] mode, it adjusts for the dead-time losses by taking very short acquisitions and applying a correction in ***real time*** — that is, as the data are coming in — to the number of counts in the spectrum. This technique allows the gamma-ray flux to change while the acquisition is in progress, yet the total counts recorded in each of the peaks are correct. The resulting spectrum has no dead time at all — in ZDT mode, the *data* are corrected, not the acquisition time. Thus, the net counts in a peak are divided by the real time to determine the count rate.

ZDT mode has a unique feature in that it can store both the corrected spectrum and the uncorrected spectrum, or the corrected spectrum and the uncertainty spectrum. Therefore, supported MCBs allow you to choose between three **ZDT Mode** settings on the ADC tab under **MCB Properties...**: **Off**, **NORM_CORR**, and **CORR_ERR** (see page ?).

Off — Uncorrected Spectrum Only

In this mode, only the uncorrected spectrum (live time and real time with dead-time losses) — also called the *live-time-corrected* or *LTC* spectrum — is collected and stored in the .SPC file. The LTC spectrum can be used to determine exactly how many pulses at any energy were processed by the spectrometer. The corrected spectrum gives the best estimate of the total counts that would have been in the peak if the system were free of dead-time effects. The uncertainty spectrum can be used to calculate the counting uncertainty, channel by channel, in the corrected spectrum.

NOTE When the spectrometer is placed in ZDT mode, the throughput of the instrument is reduced somewhat as extra processing must be done on the spectrum; therefore, if the gamma-ray flux is not changing as a function of time, but absolute highest throughput is desirable, you may wish to store only the LTC spectrum in the MCB memory.

[13]U.S. Patent 6,327,549.

NORM_CORR — ZDT and Uncorrected Spectra Stored

When the ZDT mode is set to **NORM_CORR**, the two spectra stored are the LTC spectrum and the ZDT spectrum (corrected for the dead-time losses; real time only). Unfortunately, in the analysis of the ZDT spectrum, the uncertainty of the measurement cannot be determined using either spectrum.

NOTE This mode is not useful for quantitative analysis if the counting rate varies significantly during the measurement time, particularly if the user desires an accurate counting rate and standard deviation calculation. *When you select the NORM_CORR mode, GammaVision ignores the ZDT spectrum and analyzes the LTC spectrum as it would for the **Off** ZDT mode.*

CORR_ERR — ZDT and Error Spectra Stored

In the **CORR_ERR** mode, the estimation of the statistical uncertainty is stored in place of the LTC spectrum, and is referred to as the *error spectrum* (ERR). In this mode, the ZDT spectrum is used to measure the counts in a peak, and the error spectrum is used to determine the uncertainty of the measurement made in the corrected spectrum.

For example, if the area of a peak is measured in the corrected spectrum by summing channels 1000 to 1100, the variance of the measurement can be determined by summing the counts in channels 1000 to 1100 in the error spectrum. Or, shown another way, the counts in channel *i* can be expressed as $N(i) \pm \sqrt{V(i)}$ with a 1-sigma confidence limit, where *N* is the corrected spectral data and *V* is the variance (error) spectral data.

The live time is set to the real time within the analysis engine during the analysis of ZDT spectra.

Table 1 shows which spectra are collected in the three possible ZDT modes.

Table 1. ZDT Modes.

Mode	Uncorrected Spectrum	ZDT Corrected Spectrum	ZDT Error Spectrum
Off (ZDT Disabled)	Yes	No	No
NORM_CORR (ZDT–LTC Mode)	Yes	Yes	No
CORR_ERR (ZDT–ERR Mode)	No	Yes	Yes

Choosing a ZDT Mode

When the counting rate is essentially constant during the time required to acquire the spectrum, the standard mode — **ZDT Off** — is the preferred mode; only the uncorrected spectrum is collected and stored in the spectrum file. But, if the counting rate varies significantly during the measurement time, the standard mode will not yield the proper dead-time-corrected counting rate. This can be most easily understood by noting that the uncorrected mode compensates for dead-time losses by extending the real counting time. Hence a sample containing both a short-lived high-activity isotope and a long-lifetime lower-activity isotope will experience very high dead-time losses during the first few seconds of the measurement, as the short-lifetime isotope decays rapidly. This high dead time will cause the counting time to be extended after the short-lived isotope has decayed to zero activity, and the system will count the low-activity isotope for the extra time. Consequently, the average activity of the short-lived isotope will be underestimated.

If you anticipate significantly varying counting rates during the time taken to acquire the spectrum, the **CORR_ERR** ZDT mode should be used. The **CORR_ERR** mode corrects for dead-time losses over minuscule time intervals by adding counts to the ZDT spectrum in proportion to the instantaneous ratio of real time to live time. Thus, the dead-time correction can correctly track rapidly changing counting rates. The **CORR_ERR** mode should be used whenever the counting rate may change significantly during the measurement time. In addition to the rapidly-decaying isotope example above, the **CORR_ERR** mode should be used when monitoring cooling water flow from a nuclear reactor. The **CORR_ERR** mode accommodates brief bursts of high-activity in the water flowing past the gamma-ray detector. Both the corrected and error spectra are stored in the resulting spectrum file.

Note that the counts in the ZDT spectrum must be divided by the elapsed REAL time to compute the dead-time corrected counting rate. It is important to note that the standard deviation in the N_{ZDT} counts in a gamma-ray peak in the ZDT spectrum is not $\sqrt{N_{ZDT}}$. Instead the standard deviation is obtained from the N_{ERR} counts in the same peak ROI in the accompanying error spectrum. The standard deviation in this case is $\sqrt{N_{ERR}}$. And the standard deviation in the computed counting rate, $\sqrt{N_{ZDT}} / Real\ Time$, is $\sqrt{N_{ERR}} / Live\ Time$.

The NORM_CORR Diagnostic Mode

Why is there a **NORM_CORR** mode, and why should you avoid using it? This mode simultaneously collects the ZDT spectrum and the conventional uncorrected spectrum. It is useful for demonstrating that the counts in the uncorrected spectrum divided by the live time is the same counting rate as the counts in the ZDT spectrum divided by the real time, in the special case of constant counting rate. Because the error spectrum is not collected in **NORM_CORR** mode, the standard deviation in the ZDT counts cannot be calculated if the counting rate is

varying. GammaVision provides some protection for users if the **ZDT-LTC** mode is inadvertently selected. In this case, GammaVision v6.06 ignores the ZDT spectrum and presumes you intended to use the uncorrected spectrum in a constant-counting-rate application.

To summarize:

- Use the ZDT **Off** mode when the counting rate is expected to be constant during the time taken to acquire the spectrum.

- Use the ZDT **CORR_ERR** mode when the counting rate is expected to change or might change significantly during the time required to acquire the spectrum.

- Avoid using the **NORM_CORR** mode because GammaVision v6.06 will default to analyzing the LTC spectrum and will ignore the ZDT spectrum.

More Information

Visit our website or contact your ORTEC representative for more detailed information:

- Application note AN56, "*Loss Free Counting with Uncertainty Analysis Using ORTEC's Innovative Zero Dead Time Technique*," (http://www.ortec-online.com/pdf/an56.pdf)

- General gamma spectroscopy technical papers (http://www.ortec-online.com/papers/reprints.htm#General)

5.2.10.7. Setting the Rise Time in Digital MCBs

To achieve the best results for your application, when using a digital spectrometer, such as the DSPEC Pro, DSPEC jr 2.0, DSPEC jr, digiDART, DSPEC Plus, or DSPEC, we recommend that you set the rise time of the pulses being processed by the digital filter to the minimum value for the resolution needed.

The pulse rise time (and also fall time) is based on the time required for each pulse to reach its peak value. This "peaking time" is about twice that indicated by the conventional time constants displayed on the front panel of commercial analog amplifiers. For example, germanium detectors are often specified at a 6-µs time constant; this setting is equivalent to 12-µs peaking (rise) time in our digital spectrometers.

Up to some value of rise time, one can expect improved resolution with increasing rise time; there will, however, be a tradeoff in maximum throughput to memory. Figure 89 illustrates an example of this tradeoff. ORTEC digital spectrometers operate well above the peak of the throughput curve. Operating there allows these instruments to handle an even higher rate of

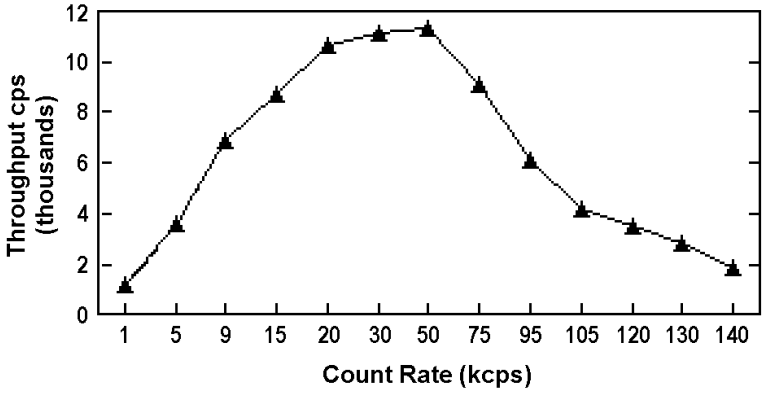


Fig. 89. An Example of the Tradeoff Between Throughput and Count Rate.

incoming counts, but with less data into memory and, therefore, longer counting time to the same detection limit. It is possible to move the peak of the curve to the right (more counts to memory with higher input count rate) by reducing the pulse rise (and fall) time, thereby trading off resolution for maximum count rate.

Table 2 is a guide to choosing a count rate that will ensure that the most efficient operation of your digital spectrometer over the range of anticipated input count rates for your application — that is, at or below the throughput peak — while achieving the best resolution obtainable from the detector consistent with that requirement. Enter the rise time that best matches your dynamic range of count rate (note that the available rise-time settings will vary by instrument; this chart is a general guide only).

Table 2. Rise Time Selection Guide.

Input Count Rate Dynamic Range	Maximum Throughput	Rise Time (µs)
0--->20000	9000	12
0--->50000	12500	8
0--->75000	23500	4
0--->100000	37000	2.4
0--->150000	50000	1.6
0--->200k	70000	0.8
0--->220k	85000	0.6
0--->250k	100000	0.4
0--->300k	120000	0.2

The longest rise time shown in the table is 12 μs, even though some digital instruments can be set for rise times as long as 23 μs. If throughput is not an issue because all samples are low rate, increasing the rise time beyond 12 μs might achieve a small improvement in resolution. For planar detectors, such as ORTEC's GLP, Si(Li), IGLET, and IGLET-X Series, operating at longer rise times frequently gives improved resolution.

5.3. Calibrate

The calibration of the system defines three relations:

1. Spectrum channel numbers and energy
2. FWHM of the peak and energy
3. Spectrum count rate and activity in becquerels or other units

The data collected are in counts/unit time/channel; however, to be most useful, these data need to be converted to activities (i.e., decays/unit time at a given energy). The calibration parameters do this conversion.

These relationships are calculated from spectra, user inputs, and inputs from libraries and tables. The calibration data are merged with the spectrum when it is saved as a spectrum file. The information is used in the analysis section to perform the desired analysis.

NOTE ScintiVision can read spectrum files created by other software products such as MAESTRO-32 and GammaVision®-32.

It is important that the calibrations, both energy and efficiency, be done correctly because the calibration results will affect all analyses employing these calibrations. The energy calibration data is used to define the energies of the peaks in the spectrum. If incorrect, the calculated energies will not correspond to the correct library entry and the peak might be incorrectly identified. The shape parameters are used to define the expected shape for a singlet peak. If incorrect, peaks might be calculated incorrectly yielding poor analysis results.

An incorrect efficiency calibration can cause the nuclide activity to be incorrectly reported. A poor shape calibration can result in a good fit to poor data, which will yield a poor efficiency calibration

The energy calibration and the efficiency calibration are separated to make it easy to do these calibrations. If properly chosen sources and libraries are used, the calibration process is simple, quick and accurate. The **Learn Calibration Sequence...** mode makes repeated calibrations with the same source(s) simple, and will perform both energy and efficiency calibrations together.

Figure 90 shows the **Calibrate** menu. The energy and efficiency calibration of the spectrum in the Detector are only available if the Detector is not acquiring data. If there is no energy calibration, all choices except **Energy...** and **Recall Calibration...** are gray. If the efficiency calibration exists, there is a check mark by the **Efficiency...** command.

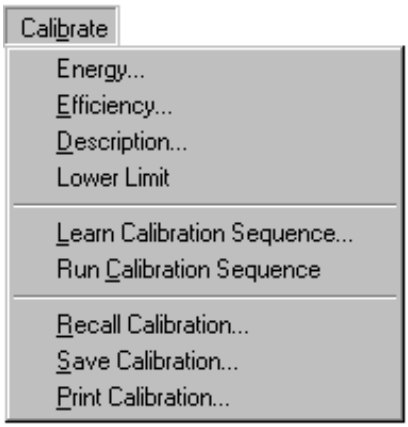


Fig. 90. Calibration Menu.

Graphs of the calculated fits and tables of the input values, fits and differences are shown for the three relationships in the calibration mode.

5.3.1. Energy...

5.3.1.1. Introduction

The **Energy...** calibration function calculates two sets of parameters: the energy vs. channel number, and the peak shape or FWHM vs. energy. The inputs to this function are a spectrum or series of spectra with isolated peaks distributed over the energy range of interest, and either a library or table of peak energies. The library referred to here is an analysis gamma-ray library. The creation of a table of peak energies is described in this section.

The formula for energy vs. channel number is:

$$E = a_1 + (a_2 \cdot C) + (a_3 \cdot C^2) \qquad \textbf{(2)}$$

where:

E = energy
a_i = coefficients
C = channel number

The formula for FWHM vs. energy is:

$$F = b_1 + (b_2 \cdot C) + (b_3 \cdot c^2) \qquad \textbf{(3)}$$

where:

F = FWHM
b_i = coefficients
C = channel number

The same methods used to calculate the peak centroid and width in the **Calibrate** commands are used in the **Analyze** functions. This ensures consistency of results. If fewer than four peaks are used for the calibration, the quadratic coefficient is zero.

The energy calibration is done using spectra in a Detector, buffer, or disk file window. The calibration is linked to the spectrum used and is transferred with it when the spectrum is transferred (e.g., from Detector to buffer or disk file).

5.3.1.2. Performing the Energy Calibration

The first step in the calibration is to collect a spectrum of a known source with isolated peaks. The spectrum peaks must be well-defined with a small statistical uncertainty. When the Detector has finished collection (i.e., stopped), select **Calibrate** from the menu bar, then **Energy...**. At this point, ScintiVision will expand the active spectrum window and close any inactive windows.

Fig. 91.

The Energy Calibration Sidebar (Fig. 91) will automatically be placed over the Status Sidebar. If you wish, you can drag the Calibration Sidebar by its Title Bar to another position.

NOTE To use the keyboard on the Energy Calibration Sidebar, press **<Tab>** to move from field to field.

If there is no energy calibration or the calibration has been destroyed, the box shown in Fig. 92 opens. If you know the approximate FWHM in channels of a peak near the center of the spectrum, enter it in the box. Otherwise, it is strongly recommended that you mark an ROI on a single isolated peak and click on **OK**. Select a peak in the high-energy (high-channel-number) part of the spectrum, and be sure to mark several channels on either side of the peak, to be used as background. When the FWHM has been calculated, the centroid of the peak will be displayed in the upper part of the calibration input window as, in this example, **Channel: 210.01**. This is the channel number of the peak centroid. Now use the mouse to select the **E=** field and enter the energy of this peak. Press **<Enter>** or click on the **Enter** button.

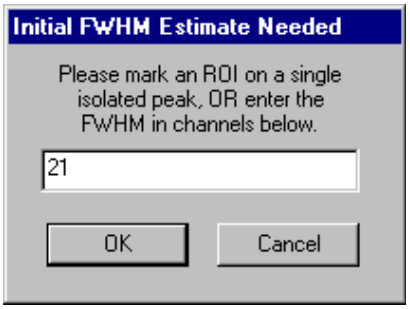

Initial FWHM Estimate Needed
Please mark an ROI on a single isolated peak, OR enter the FWHM in channels below.
21
OK
Cancel

Fig. 92. Estimate FWHM.

An **Energy Table** and **Energy Calibration Fit** graph will appear on the screen (see Fig. 93). They can be moved around and resized if you wish. The graph and table each have their own control menus. The table will show one value (the one just entered), and the graph will show a straight-line fit from (energy = 0, channel = 0) to the energy and channel just entered. This is an approximate calibration; it should be fairly accurate if the zero offset is small.

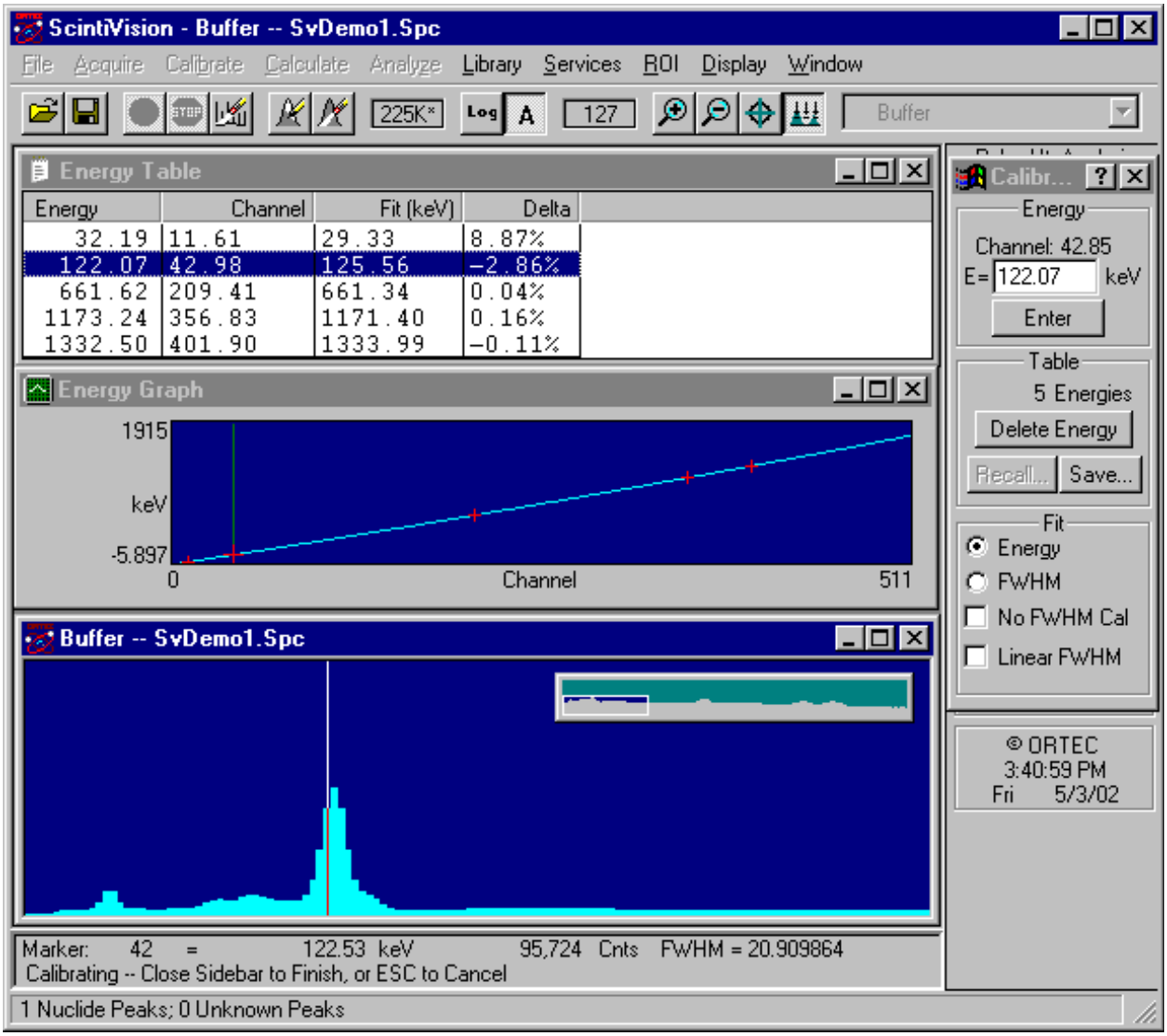


Fig. 93. Energy Calibration.

On the Calibration Sidebar, the **Fit** radio buttons allow you to display either the Energy-channel or FWHM-Energy table and graph. Select **FWHM Fit** now, and the table will show the one value entered, while the graph shows a horizontal line. For a single point, the FWHM is assumed to be a constant.

NOTE It is very important in the analysis of these spectra that the FWHM be correct!

In the spectrum window (or the library), select a peak in the low-energy part of the spectrum (or collect another spectrum of a different source) and move the marker to the centroid of the peak. Again, mark the peak as an ROI, and position the marker at the center of the peak. Click on the **E=** field and enter the energy of this peak. Both the energy function and FWHM function will be updated with the new entry. The graphs and tables are displayed so that progress can be monitored.

At this time, the marker can be positioned using the calibration graphs, calibration table, or the spectrum window. The marker will show the energy based on the calibration up to this point.

Note that until more than 3 points are included in the calibration, the sidebar's **Linear FWHM** checkbox is marked and gray, and ScintiVision automatically performs a linear fit. You can refine the calibration by adding as many points as desired. Any point can be deleted by selecting that point in the table of values (Energy or FWHM) and clicking on the **Delete Energy** button. The fit updates when a point is removed. If the quadratic fit to the FWHM does not produce a good result, the FWHM function can be set to be a linear fit of the points by clicking the **Linear FWHM** box in the bottom of the sidebar. This is mainly used when there are only a few points in the calibration.

If the quadratic fit to the FWHM does not produce a good result, the FWHM function can be set to be a linear fit of the points by clicking the **Linear FWHM** box in the bottom of the side bar. This is mainly used when there are only a few points in the calibration.

Other Energy Calibration Sidebar Features

Note the **Save...** and **Recall...** buttons in the Calibration Sidebar's **Table** box. The **Save...** button stores the energy (keV), the centroid channel, and the FWHM (channels) in an ASCII table file called an *energy table file*, assigned the extension **.ENT**. The saved tables of values can be used for future calibrations using the same nuclides, by clicking on the **Recall...** button. **.ENT** files can be edited with **Edit File** in the sidebar's control menu (Fig. 94; click the Title Bar icon on the Calibration Sidebar), or offline with an ASCII editor such as Windows Notepad.

Fig. 94. Calibration Sidebar Control Menu.

Other menu items in the sidebar control menu are **Move**, **Close**, **Restore**, and **Destroy**. **Destroy** clears the internal energy calibration table. **Restore** reinstates the internal energy calibration table to the values before **Destroy** was chosen, but only if done before exiting the **Energy...** calibration function. **Close** exits the **Energy...** calibration function and saves the current calibration as the working calibration.

5.3.1.3. Speeding Up Calibration with a Library

A library can be used to speed up the calibration process as follows. Before entering the calibration process, select **Library/Select File...** from the menu and choose a library with the nuclides in the calibration source. Next, click on **Library/Select Peak...** to display the list of peaks in the library in energy order. Now select **Calibrate/Energy...**. When the table and graph appear, move the table down so the peak list is not covered (see Fig. 95).

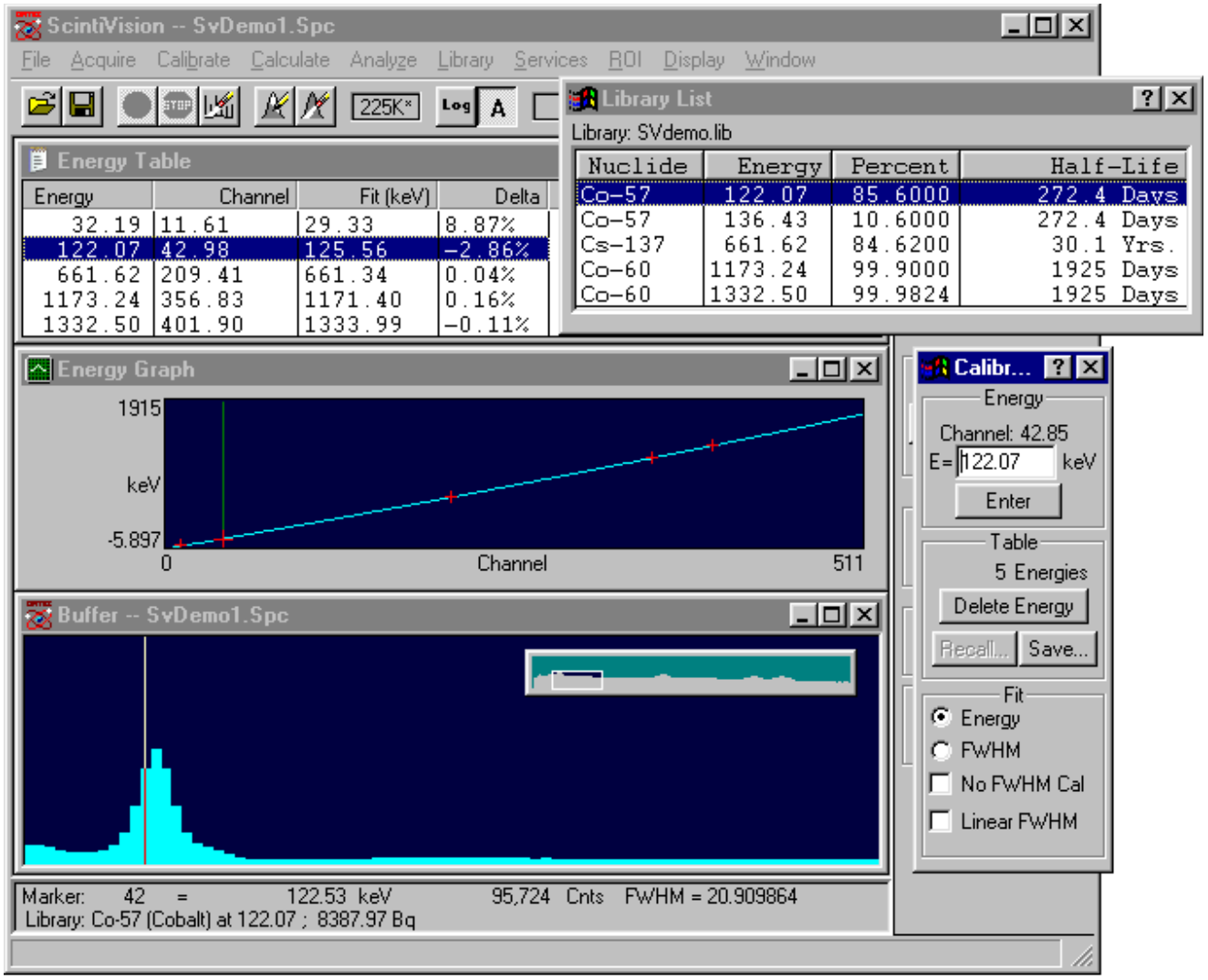


Fig. 95. Speeding Up Calibration with a Library.

Rather than manually entering the peak energy in the energy entry box, click ***once*** on the peak energy in the library list to automatically enter that library energy value in the **E=** field.

For a spectrum with an energy calibration, double-clicking on a library peak will cause the spectrum cursor to jump to the channel which corresponds to that energy. If the calibration as it now stands is not sufficiently accurate, the channel which corresponds to that energy might be off by a channel or two. If this is not the correct peak channel, move the cursor to the correct channel, click ***once*** on the library peak, and press **<Enter>**.

To exit the calibration function, click on the Energy Calibration Sidebar's Close button ( ). This will close the calibration function, and the new calibrations will be held in memory, available for subsequent spectra gathered on this Detector. If a calibration is to be saved permanently to disk, select **Save Calibration...** from the **Calibrate** menu.

5.3.1.4. Using Multiple Spectra for a Single Calibration

To use more than one source (when simultaneous collection is not possible) to make a single calibration:

1. Collect a spectrum with one source.
2. Calibrate with this spectrum.
3. Exit the calibration function.
4. Clear the Detector.
5. Collect the spectrum of the second source.
6. Calibrate by adding the new lines to the existing ones (which are retained).

The process can be repeated for additional sources. When completed, the calibration should be saved on disk. The individual spectra can be saved; used in other application software; and the calibrations in the spectra updated by recalling each in turn, recalling the complete calibration, and re-saving the spectrum.

To use more than one stored spectrum to make a single calibration:

1. Calibrate using one spectrum.
2. Exit the calibration function.
3. Save the calibration in a file.
4. Recall the second spectrum.
5. Recall the calibration (because recalling the spectrum has replaced the first calibration with the calibration from the spectrum).
6. Select **Calibrate/Energy...** and enter the peak energies for the second spectrum.

The process can be repeated for additional spectra.

5.3.2. Efficiency...

5.3.2.1. Introduction

The **Efficiency...** calibration function calculates the detection efficiency of the NaI Detector system as a function of energy. The efficiency of the Detector is the relation between the number of gamma rays emitted from the source to the number of gamma rays collected in the full-energy peak (see Fig. 96).

The NaI Detector system efficiency includes effects from the Detector itself, the Detector-source geometry, the materials surrounding the Detector, and absorption in the source material or matrix. This is shown in Fig. 97.

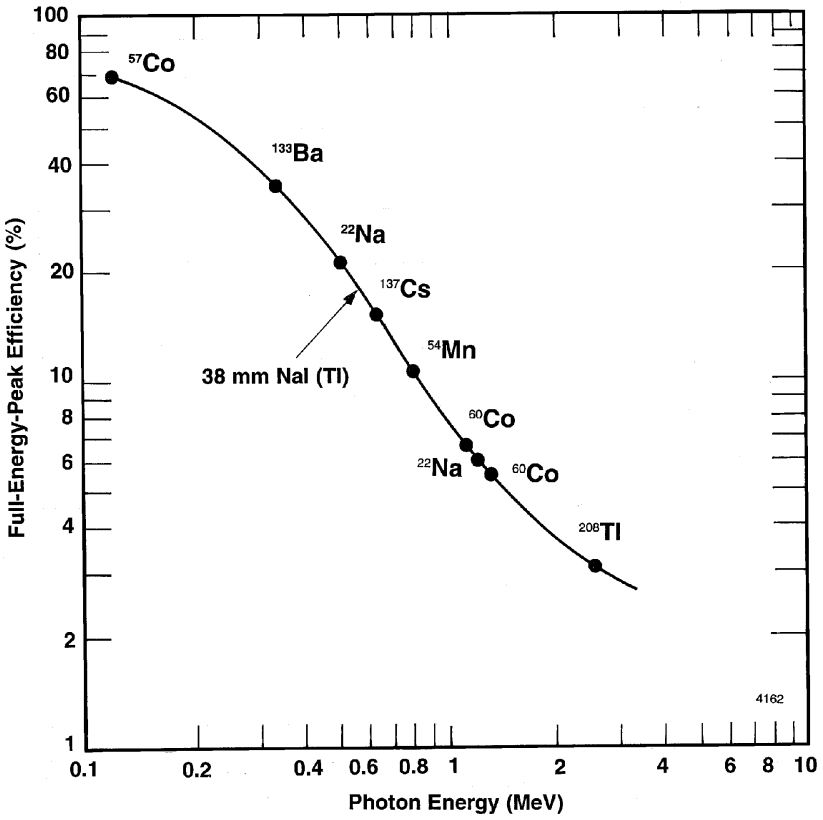


Fig. 96. Detector Efficiency as a Function of Energy.

In general, it is not good practice to use efficiency calibrations from one Detector-source geometry for other geometries. Different calibration files can be made for all the different source-Detector combinations to compensate for the differences between the geometries. You choose the output filename for each of the different calibrations, which can subsequently be specified, for different sampling geometries, using **Recall Calibration...**.

The efficiency is defined as a function of energy. Therefore, the **Energy...** calibration must be done first. The **Efficiency...** command remains grayed (disabled) until the spectrum has been energy calibrated.

NOTE The energy recalibration can be redone (to account for gain changes) without the need to redo the efficiency calibration.

The efficiency calibration is critically important to the accuracy of the activity results from ScintiVision. We recommend that you use only calibrated sources traceable to a known standard. The time between the calibration of the radionuclide source by its manufacturer and the time the spectrum is collected is important, as this defines the decay correction needed to calculate source strength for the spectrum.

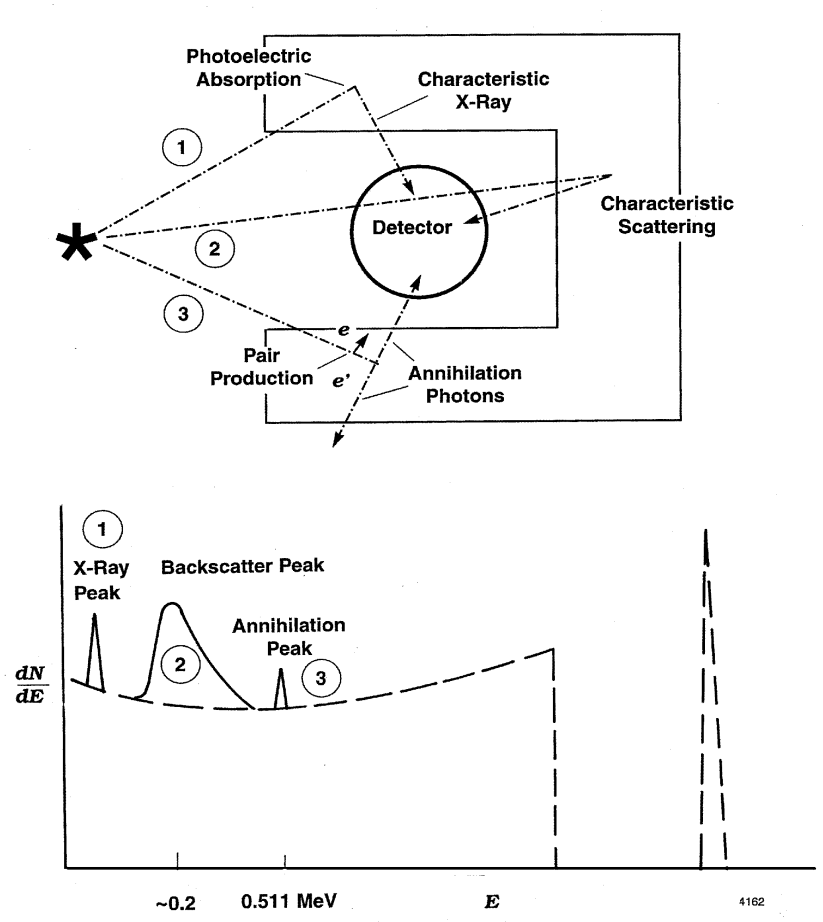


Fig. 97. Detector with Extended Source.

The selected source(s) should contain isolated singlets over the entire energy range of interest. If desired, the efficiency calibration can be performed using one or more spectra to minimize the difficulty of obtaining the required number of singlets.

To perform the calibration, you need an energy-calibrated spectrum of the radionuclides and their source strengths and calibration dates. These data are entered into the program in convenient menu-type forms, and you can review the results of each step. Questionable points can be deleted, additional points added, and the fitting process repeated, until you obtain the desired result.

The NaI analysis package uses a four-term polynomial or cubic fit of the logarithm base 10 of efficiency to the logarithm base 10 of energy. At least four well-separated peaks are needed for the polynomial fit. If fewer peaks are provided, a quadratic or linear fit is performed. With the minimum number of points, the fit will be reported as exact for all data points, but the calibration could be inaccurate elsewhere.

If the input points are not well separated, the best fit to the data points might not be an accurate representation of the efficiency outside the fitted region.

The efficiency (energy) formula is:

$$\varepsilon = 10^{(a_1 + a_2(\log_{10}(E)) + a_3(\log_{10}(E))^2 + a_4(\log_{10}(E))^3)} \quad \textbf{(4)}$$

where:

ε = efficiency at energy E
a_1 = fitting coefficients
E = energy

The result of the efficiency calibration calculation is a set of coefficients and a set of energy-efficiency pairs. These pairs can be used to recalculate the efficiency and to display the efficiency plot.

5.3.2.2. Performing the Efficiency Calibration

To efficiency calibrate the system:

Collect an energy-calibrated spectrum of the known standard for a time sufficient to get well-formed peaks with small uncertainty. The certificate supplied with the source will have the energies, gammas/second, nuclide names, and measurement date needed in the calibration.

Expand the spectrum horizontally to show the peaks completely. Select **Calibrate/Efficiency...** from the menu. This will display the Efficiency Calibration Table and Graph, and the Efficiency Calibration Sidebar shown in Fig. 98. (As noted above, if the **Efficiency...** item is gray, the system must first be energy calibrated.)

Fig. 98. Efficiency Calibration Sidebar.

Choose a spectrum peak listed in the source data sheet. Put the marker on the center of the peak; this selects the peak.

Click on the **Calc...** button on the Efficiency Calibration Sidebar. This will open the **Efficiency Calc. Worksheet** dialog for entering the data about the peak (Fig. 99).

The peak area and count rate are calculated in the same manner as in the analysis program. In the **Assay (from Certificate)** section, select the **Date** field and enter the calibration date from the source data sheet, as well as

the calibration **Time**. Enter the gammas/second from the source in the **Activity** field, and set the units to GPS. The **Uncertainty** is the total uncertainty for the nuclide as given in the source certificate. This includes the uncertainty for the activity, the half-life, and the yield.

Advance to the **Nuclide Half-Life** box and enter the half-life in days for this nuclide if the value from the library is not shown. The use of the **Library** checkbox is discussed in Section 5.3.2.3. Note that the peak count-rate value (**Counts/Sec.**) in the **Peak Measured (from Spectrum)** section is already filled in, based on the selected peak.

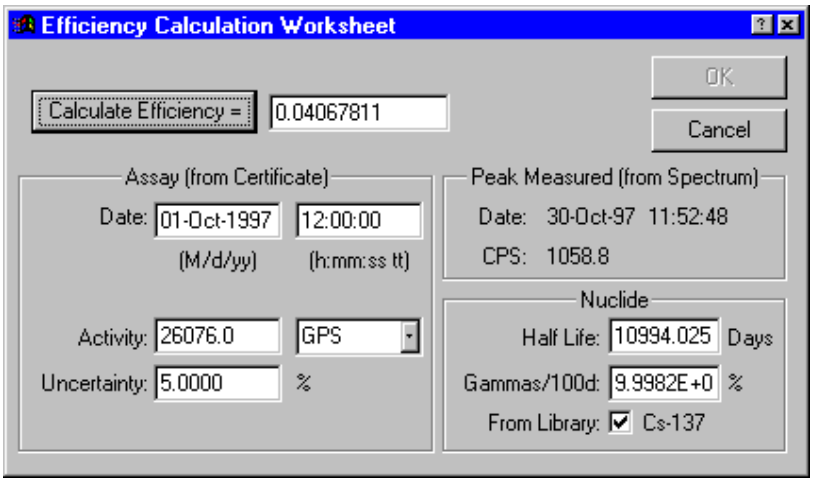


Fig. 99. Efficiency Calibration Worksheet.

When the values are correct, click on **Calculate Efficiency=**. The efficiency will be calculated and displayed in the field at the top of the worksheet dialog. Click on **OK** to close the worksheet. If this value is acceptable, click on the **Enter** button in the Efficiency Calibration Sidebar to save the input and efficiency values.

Select the next peak and repeat the process. The date and time will default to the previously entered values, but the half-life and gammas/second must be entered for each energy unless the **Library** and **Activity...** features are used.

As each peak is entered, the table and graph will update and new fits will be made.

NOTE A linear fit is made for one or two points, a quadratic fit is made for three points, and a cubic fit is made if four or more points are entered.

Any point can be deleted by selecting the value in the **Efficiency Table** window and clicking on the **Delete Entry** button in the efficiency calibration sidebar. (**Delete Entry** is normally grayed, but becomes active when a value is selected from the table.)

Any point can be modified by selecting the value in the table dialog and clicking on **Calc...**. When the worksheet opens, the previously entered values will be shown.

Saving the Efficiency Calibration Table

The table of entries, including the gammas/second, half-life, and certification date (i.e., all the information needed to do the calibration), can be saved by clicking on the **Save...** button in the **Table** section of the sidebar. This opens the **Save Efficiency Table** dialog shown in Fig. 100.

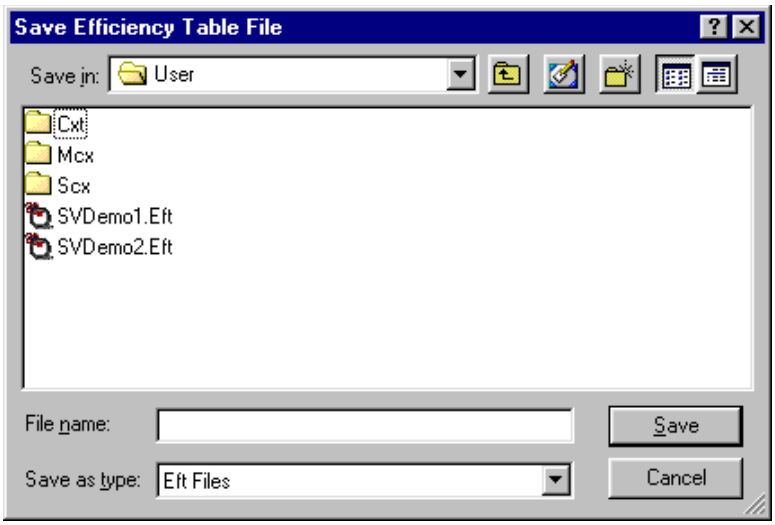


Fig. 100. Save Efficiency Table.

The table is saved as an ASCII file with the default extension **`.EFT`**. The file can be edited in ScintiVision, as described in the next paragraph, or offline with an ASCII-based text editor such as Windows Notepad.

Editing the Efficiency Calibration Table

To edit the efficiency calibration table file, open the Efficiency Calibration Sidebar's control menu and select **Edit File**. This opens the dialog shown in Fig. 101. Select the **`.EFT`** file to be edited; it will be displayed as shown.

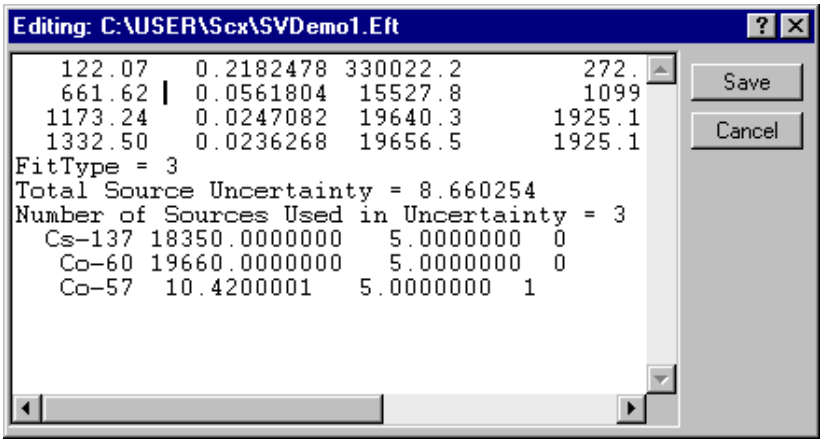


Fig. 101. Editing Efficiency Table.

The table contains the following information (by columns):

1. Gamma-ray energy (keV).
2. Efficiency (used for manual efficiency inputs, ignored if remainder of line is valid).
3. Gammas/sec for this energy, at the specified date and time.
4. Half-life of this nuclide in days.
5. Calibration date and time for the gammas/sec calibration. The gammas/sec are automatically decay corrected from the date/time in column 5 to the date/time of the spectrum acquisition.

After the energy list in the **`.EFT`** files is the following line:

```
FitType = <iFit>
```

where **<iFit>** is the fit type above the knee (0–3 or 6). The fit types are:

0	no fit and no efficiency
1	interpolative fit
2	linear fit
3	quadratic fit
6	polynomial fit

When an Efficiency Table is recalled, this line is used to select the fit type to be used.

Following the fit type are the total calculated source uncertainty, the number of nuclides in the source uncertainty calculation, and the list of nuclides used in the uncertainty calculation. The total is the individual uncertainties added in quadrature. When finished, click on **Save** to rewrite the new file to disk. To discard any changes, click on **Cancel**; a dialog will verify that you want to discard.

5.3.2.3. Using The Library in Efficiency Calibrations

The library can be used to assist in the efficiency calibration in two ways: (1) to direct the marker, and (2) as input for automatic calibration.

To open a library, select **Library/Select File...**. A list of the library peaks by energy is displayed by selecting **Library/Select Peak...**. Now select **Calibrate/Efficiency**. When the table and graph appear, move the table down so the peak list is not covered (see Fig. 102).

With the library peak list displayed, the peaks can be selected by double-clicking on the energy in the library list. This will move the marker to that energy in the spectrum (updating the view, if necessary), and change the graph and spectrum to reflect the changes.

By clicking on a library peak and then the worksheet, the worksheet is ready for the values for that peak. The half-life will be copied from the library peak list to the **Half-Life** field on the worksheet. You will only have to enter the **Gamma/Sec.**.

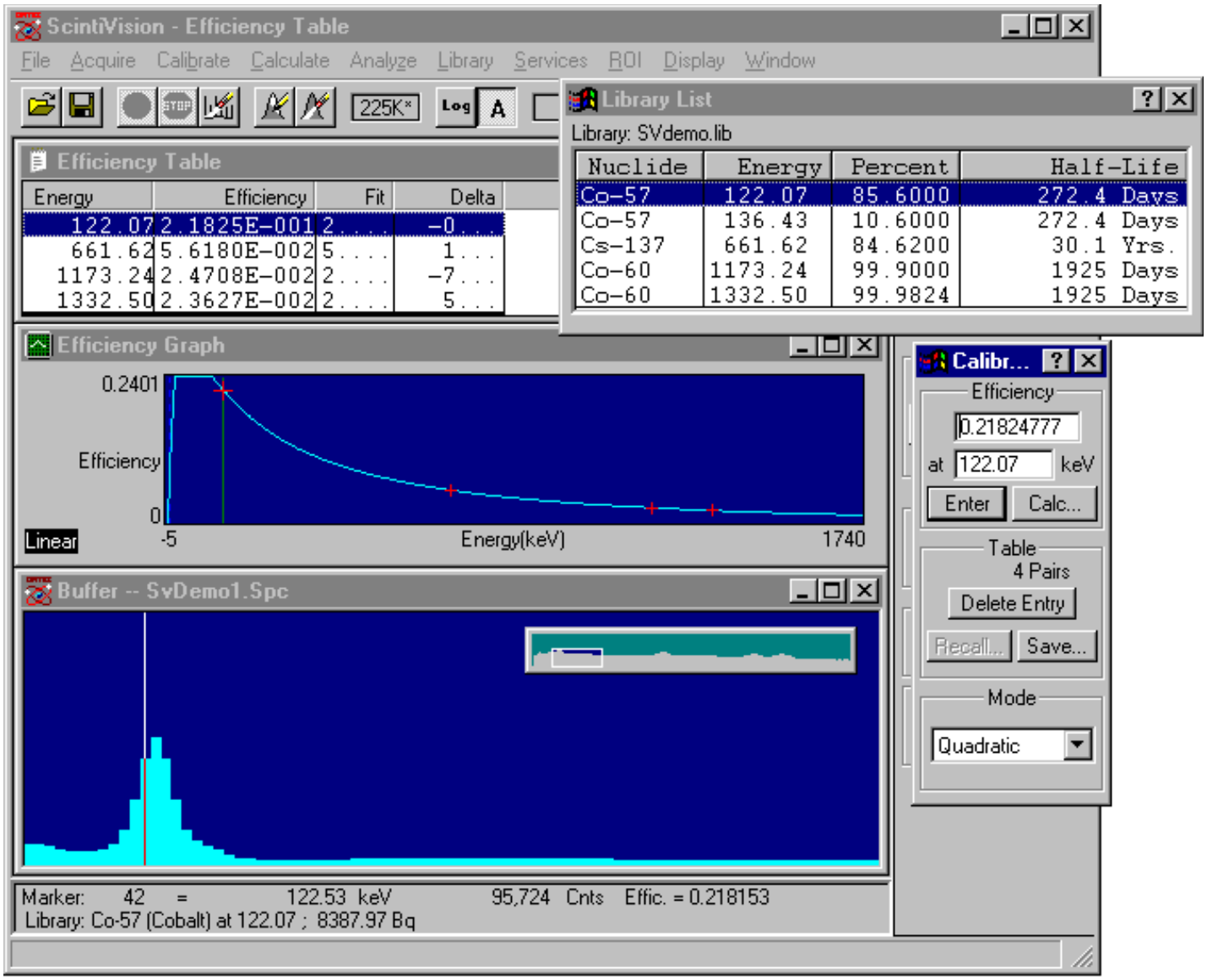


Fig. 102. Using the Library in an Efficiency Calibration.

5.3.3. Description...

This command lets you enter the calibration description in the dialog shown in Fig. 103. When finished, click on **OK**.

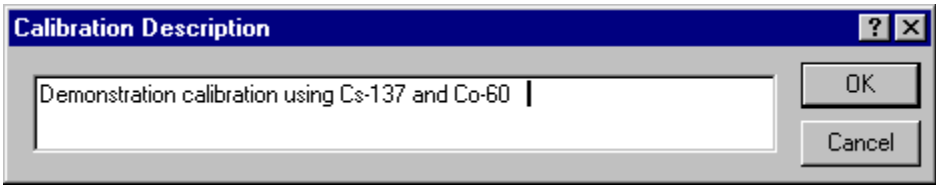


Fig. 103. Calibration Description.

5.3.4. Lower Limit

This command opens the dialog shown in Fig. 104, which allows you to set the low-channel limit to be used during calibration. This is useful when calibrating using ^{57}Co.

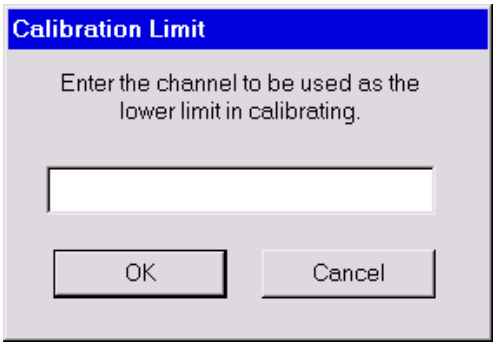


Fig. 104. Set Low-Channel Limit.

5.3.5. Learn Calibration Sequence...

To simplify the calibration process, ScintiVision allows you to create a calibration sequence with all parameters defined, and store it in a file with the extension **.CAL**. Both energy and efficiency calibrations can be performed in the same sequence.

To do this, select **Calibrate/Learn Calibration Sequence...** from the menu. This will display the **Open Calibration Sequence** dialog shown in Fig. 105. In the **File Name** field, give the sequence a name with the **.CAL** extension. Click on **OK** to close this dialog and open the **Automatic Calibration** dialog (Fig. 106).

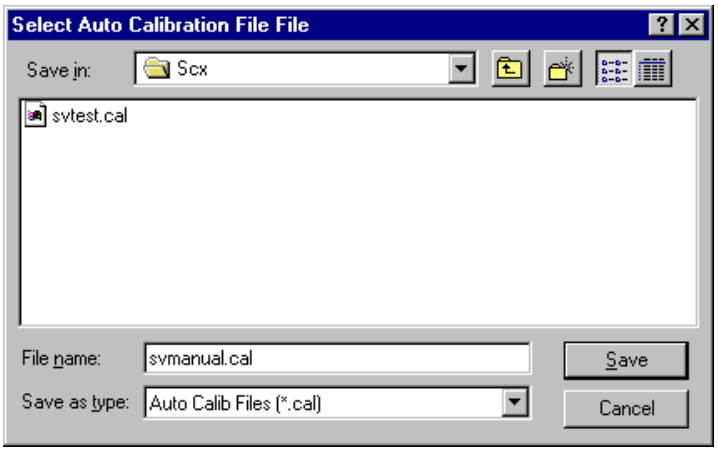


Fig. 105. Open Calibration Sequence.

The Detector list selection allows up to three lists of Detectors to defined. All of the Detectors in a list are calibrated at the same time. Each of the lists can contain one to four of the Detectors on the system. To select the Detectors to be grouped for calibration, click on **Edit List** to open the **Detector List Editor** dialog (Fig. 107). When this "learn sequence" is run, all the Detectors on the list will be calibrated.

Fill in the information about the calibration, including the **Number of Sources (1–5):**, whether or not to also calibrate the efficiency, and whether or not to save the calibration results to a file for each Detector.

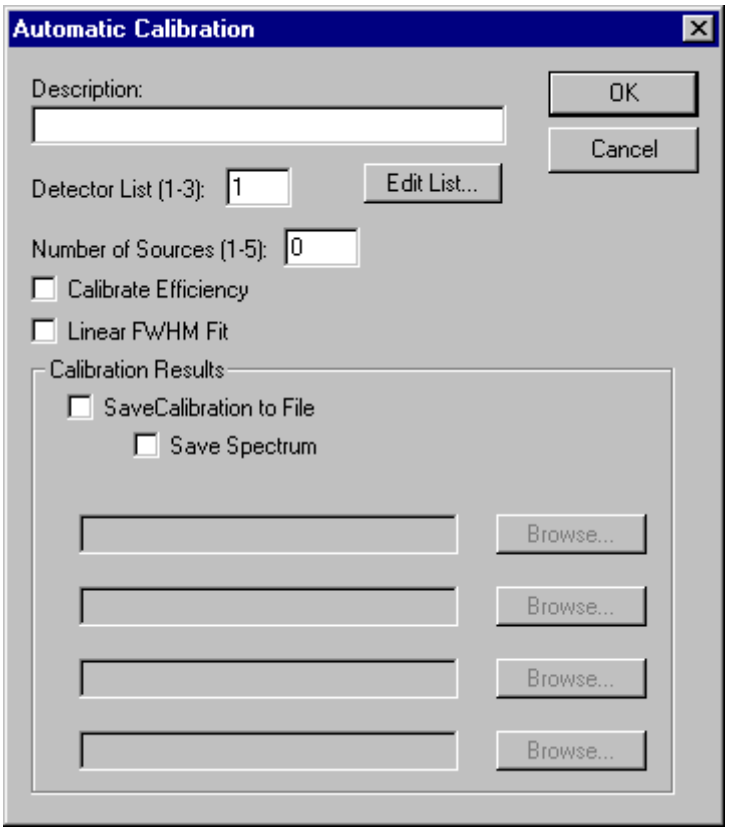


Fig. 106. Calibration Information.

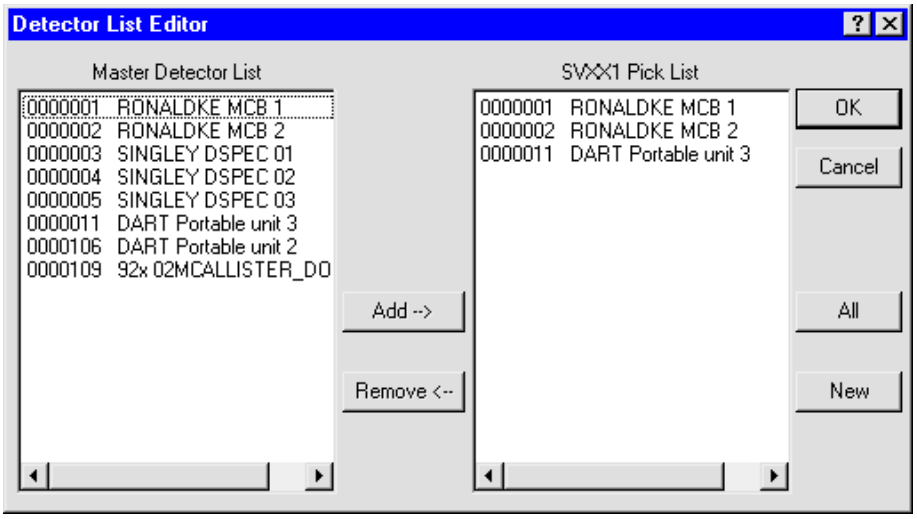


Fig. 107. Select the Detectors for the Calibration List.

Click on **OK** when the screen is completely filled in. This will open the **Calibration Source Data Sheet** dialog, shown in Fig. 108.

Enter the name or **Label** of the source, the **Count Time in Seconds**, the **Assay Date** and **Time**, the **Source Units**, the peak **Energy** in keV and **Source Strength** in gammas/sec.

If you select **Becquerels** or **Microcuries** instead of **Gammas/Sec**, fill in the activity. After the **Energy** and **Source Strength** for Peak 1 are filled in, the fields for Peak 2 will become active, and so on, for all peaks in the source. After this screen is filled in, click on **OK**. If there is more than one source (ScintiVision can use up to five), this **Calibration Source Information** dialog will be displayed for each one.

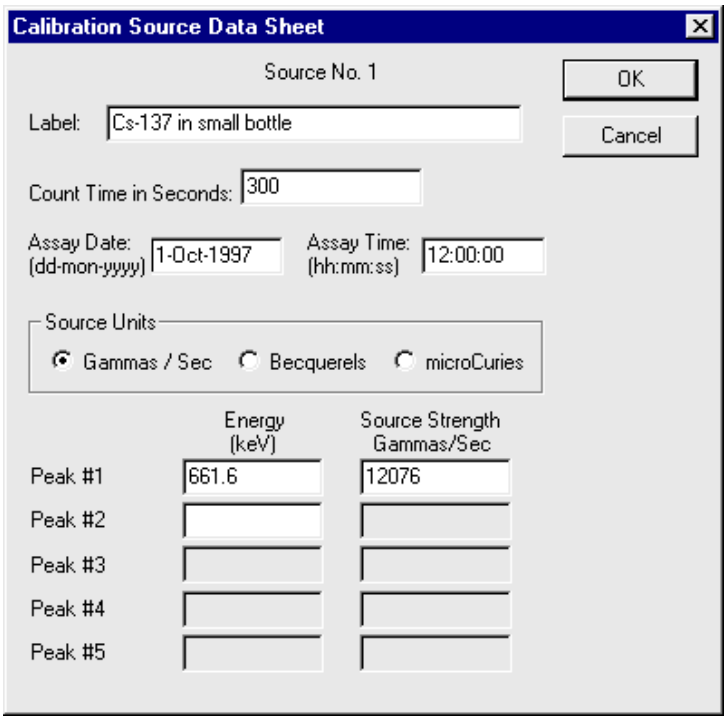


Fig. 108. Calibration Source Information.

Once all of the source information has been entered, the **Ready to count source** dialog (Fig. 109) will open for beginning the count on the first calibration source. Place the source on the Detector and click on **OK**. When the count is finished, the PC will beep.

A dialog will open, centered in the first spectrum window. In it, mark the first peak of the first source at the energy specified earlier, for the first Detector. Locate the peak in the spectrum window, expand the display to show the peak clearly, and mark the peak as an ROI. Click on the **Marked** button after the peak is marked.

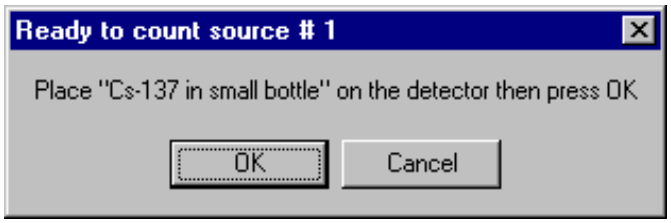


Fig. 109. Count Calibration Source.

Figure 110 shows the **Mark Peak** dialog. The same dialog appears for marking the same peak for the other Detectors. This dialog is placed in the window of the spectrum to be marked. Click on the **Marked** button after that peak is marked. Continue this sequence until all peaks for the first source are marked, each one for all Detectors.

If there is a second source, the **Ready to count source** dialog will open again for beginning the count on the second calibration source. Place the source on the Detector and click on **OK**. When the count is done, the PC will beep.

The **Mark Peak** dialog will again be displayed, this time for the first peak of the second source at the energy specified earlier, for the first Detector. Locate the peak in the spectrum window, expand the display to show the peak clearly, and mark the peak as an ROI. Click on **Marked** after the peak is marked.

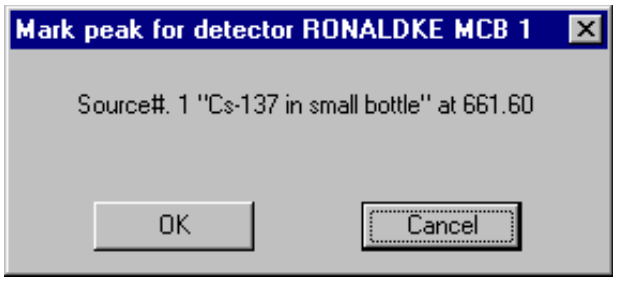


Fig. 110. Mark Peak Dialog.

The same screen appears for marking the same peak for the other Detectors. For each Detector, click on **Marked** after the peak is marked. Continue this sequence until all peaks for the second source are marked, each one for all Detectors. If more than two sources are used, continue this sequence until all peaks for each source are marked, each one for all Detectors.

This calibration sequence will then be saved, and can accessed later with the **Run Calibration Sequence...** menu item.

5.3.6. Run Calibration Sequence...

This command allows you to access the “learned” calibration sequences discussed in the previous section, for quick-and-easy, routine calibrations. The same source(s) can be used many times to quickly run the previously setup calibration sequence.

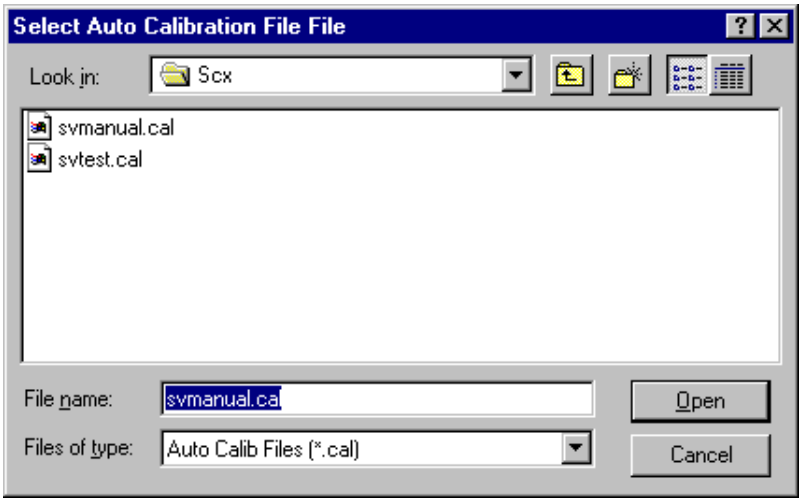


Fig. 111. Recall Calibration Sequence.

To do this, use the dialog shown in Fig. 111 to recall a calibration sequence file from the list of previously created calibration sequences. Click on **OK** to execute the learned calibration sequence. Place each source on the Detector when prompted to do so, and click on the **Begin Count** button. The PC will beep after each count is finished.

The entire calibration is completed and in place as the working calibration with just a few clicks of the mouse!

5.3.7. Recall Calibration...

This command (see Fig. 112) allows you to recall the calibration fields from the specified `.CLS` file to the working calibration for a single Detector. The current working calibration is lost. *The calibration data can be read from any* `.CLS` *or* `.SPC` *file containing the correct records.*

To change the calibration stored in a spectrum file, recall the spectrum file (its calibration is automatically loaded), recall the desired calibration, and store the spectrum back to disk.

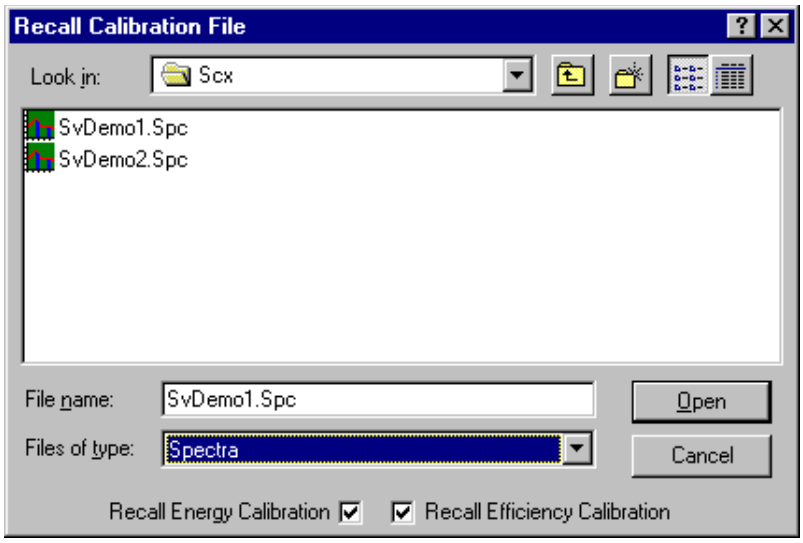


Fig. 112. Recall Calibration File.

5.3.8. Save Calibration...

Save Calibration... allows you to save the working calibration for a single Detector to a disk file in the `.CLS` format (see Fig. 113). All items in both the energy and efficiency tables are saved.

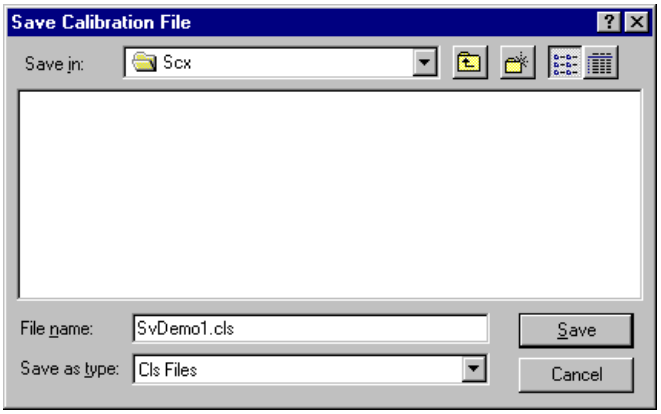


Fig. 113. Save Calibration.

5.3.9. Print Calibration...

This prints all the calibration data in the working calibration to a printer or disk file (see Fig. 114). If the calibration tables exist, they will also be printed.

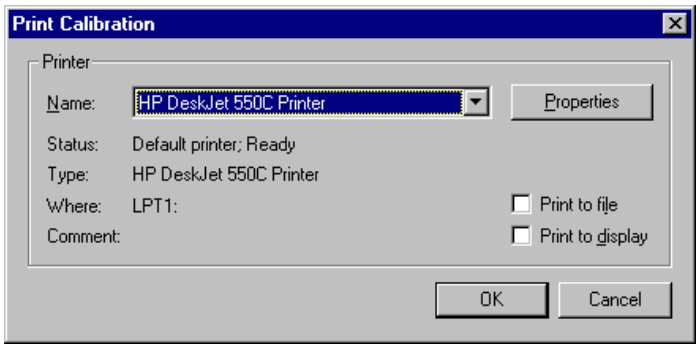


Fig. 114. Print Calibration to Printer or File.

5.4. Calculate

The **Calculate** menu (Fig. 115) provides useful analytical tools for spectrum manipulation. **Smooth** and **Strip...** are only available in buffer mode.

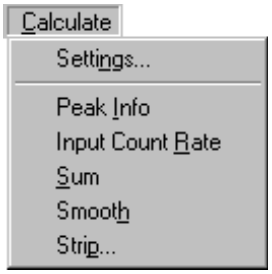


Fig. 115. Calculate Menu.

5.4.1. Settings...

This dialog (Fig. 116) displays the "x" factor used by the **Peak Info** command to calculate full width at 1/x maximum (FW[1/x]M) for the ROI peak marked by the marker. The background is subtracted before starting the calculation (see Section 5.4.2). Enter the factor **x**, an integer from 2 to 99. This number will be retained and used until changed. (**Peak Info** always prints the FWHM, so an x of 2 is not useful.)

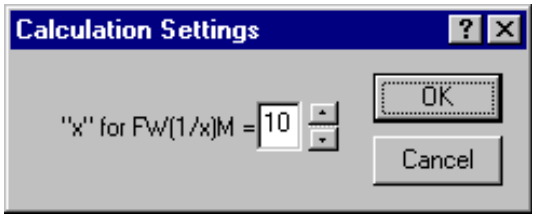


Fig. 116. FW(1/x)M Dialog.

5.4.2. Peak Info

This command does one of the following:

If the marker is in an ROI:

1. If the spectrum is not calibrated, the channel centroid, FWHM, and FW(1/x)M, in channels, are displayed.

2. If calibrated, the channel centroid, FWHM, and FW(1/x)M, in channels and energy, the gross and net area, and the library "best match" and activity are displayed.

If the marker is not in an ROI, the peak limits used are the same as the limits for the **ROI Ins**ert button on the Status Sidebar, and the report is generated according to items 1 and 2 above.

The x-factor is determined in **Calculate/Settings...**. The peak information is displayed in a pop-up box at the top of the peak (Fig. 117). It can also be displayed by double-clicking the mouse in the ROI (or on the peak) or with the right-mouse-button menu. To close the box, press **<Esc>** or click in the box.

This calculation is the same as the **Peak Info** calculation in MAESTRO, and might not give results identical to the complete analysis peak results. If the Detector is acquiring data, the values displayed are continuously updated with new values based on the new data.

The background on the low-channel side of the peak is the average of the first three channels of the ROI (see Fig. 118). The channel number for this background point is the middle channel of the three points. The background on the high-channel side of the peak is the average of the last three channels of the ROI. The channel number for this background point is also the middle channel of the three points. These two points on each side of the peak form the endpoints of the straight-line background.

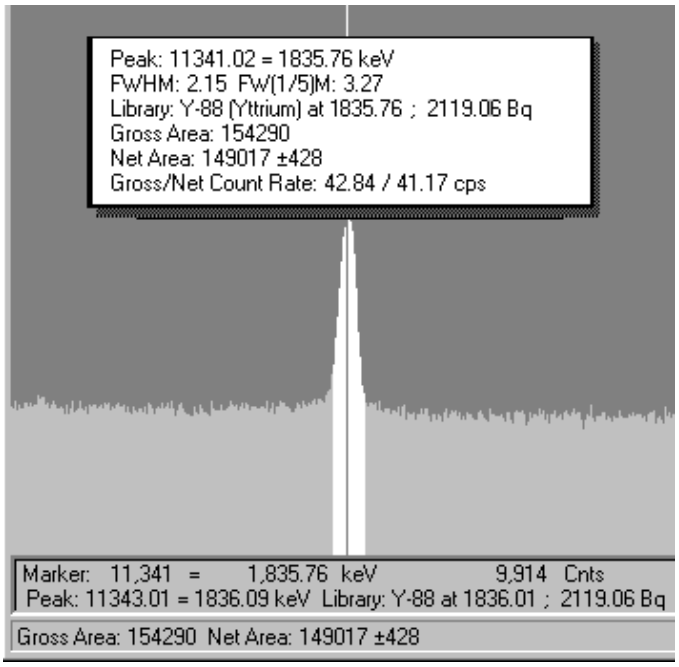

Peak: 11341.02 = 1835.76 keV
FWHM: 2.15 FW(1/5)M: 3.27
Library: Y-88 (Yttrium) at 1835.76 ; 2119.06 Bq
Gross Area: 154290
Net Area: 149017 ±428
Gross/Net Count Rate: 42.84 / 41.17 cps
Marker: 11,341 = 1,835.76 keV 9,914 Cnts
Peak: 11343.01 = 1836.09 keV Library: Y-88 at 1836.01 ; 2119.06 Bq
Gross Area: 154290 Net Area: 149017 ±428

Fig. 117. Peak Info Displayed at Top of Peak.

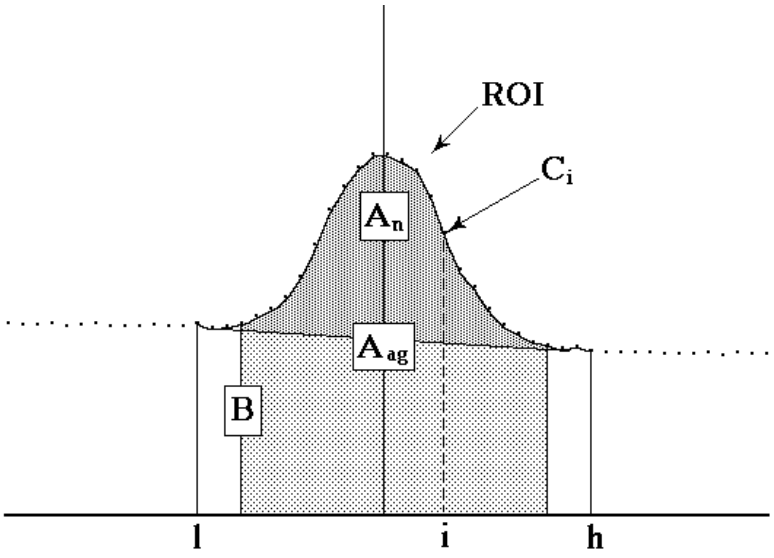


Fig. 118. Background Calculation Details.

The background is given by:

$$B = \left(\sum_{i=l}^{l+2} C_i + \sum_{i=h-2}^{h} C_i \right) \frac{h - l + 1}{6} \quad \textbf{(5)}$$

where:

B = the background area
l = the ROI low limit
h = the ROI high limit
C_i = the contents of channel i
6 = the number of data channels used (three on each end)

The gross area is the sum of all the channels marked by the ROI according to the following:

$$A_g = \sum_{i=l}^{h} C_i \quad \textbf{(6)}$$

where:

A_g = the gross counts in the ROI
l = the ROI low limit
h = the ROI high limit
C_i = the contents of channel i

The adjusted gross area is the sum of all the channels marked by the ROI but not used in the background, calculated as follows:

$$A_{ag} = \sum_{i=l+3}^{h-3} C_i \quad \textbf{(7)}$$

where:

A_{ag} = the adjusted gross counts in the ROI
l = the ROI low limit
h = the ROI high limit
C_i = the contents of channel i

The net area is the adjusted gross area minus the adjusted calculated background, as follows:

$$A_n = A_{ag} - \frac{B\ (h-l-5)}{(h-l+1)} \quad \textbf{(8)}$$

The uncertainty in the net area is the square root of the sum of the squares of the uncertainty in the adjusted gross area and the weighted error of the adjusted background. The background uncertainty is weighted by the ratio of the adjusted peak width to the number of channels used to calculate the adjusted background. Therefore, net peak-area uncertainty is given by:

$$\sigma_{A_n} = \sqrt{A_{ag} + B\left(\frac{h-l-5}{6}\right)\left(\frac{h-l-5}{h-l+1}\right)} \quad \textbf{(9)}$$

where:

A_{ag} = the adjusted gross area
A_n = the net area
B = the background area
l = the ROI low limit
h = the ROI high limit

5.4.3. Input Count Rate

The Input count rate is supported by a number of our newer digital MCBs. For these units, the input count rate can be shown in the upper left corner of the spectrum window. This is input count rate and not the number of processed pulses.

5.4.4. Sum

The **Sum** function performs its calculation in one of three ways, depending on the position of the marker:

1. If the marker is not in an ROI and a box is not defined, the sum of the data channels of the Detector is shown on the display. The complete channel width (e.g., 1 to 16384) is summed.

2. If the marker is not in an ROI and a box is defined, the sum of the data channels in the box is shown on the display.

3. If the marker is in an ROI, the sum of the data channels in the ROI is shown on the display. This is the same as the gross counts in the **Peak Info** display, but can be used on wider ROIs.

5.4.5. Smooth

The **Smooth** function transforms the data in the buffer spectrum according to a five-point, area-preserving, binomial smoothing algorithm. That is, the existing data is replaced, channel-by-channel, with the averaged or smoothed data as follows:

$$S_i = (O_{i-2} + 4O_{i-1} + 6O_i + 4O_{i+1} + O_{i+2})/16 \quad \textbf{(10)}$$

where:

S_i = the smoothed data in channel i
O_i = the original data in channel i

5.4.6. Strip...

This function strips the specified disk spectrum from the spectrum in the buffer. When **Strip...** is selected, the dialog box shown in Fig. 119 opens, prompting you for a filename and **Stripping Factor**.

NOTE The file must be a valid spectrum data file containing the same number of channels as the displayed spectrum.

The **Stripping Factor** is a real number that is multiplied channel-by-channel times the disk spectrum before being

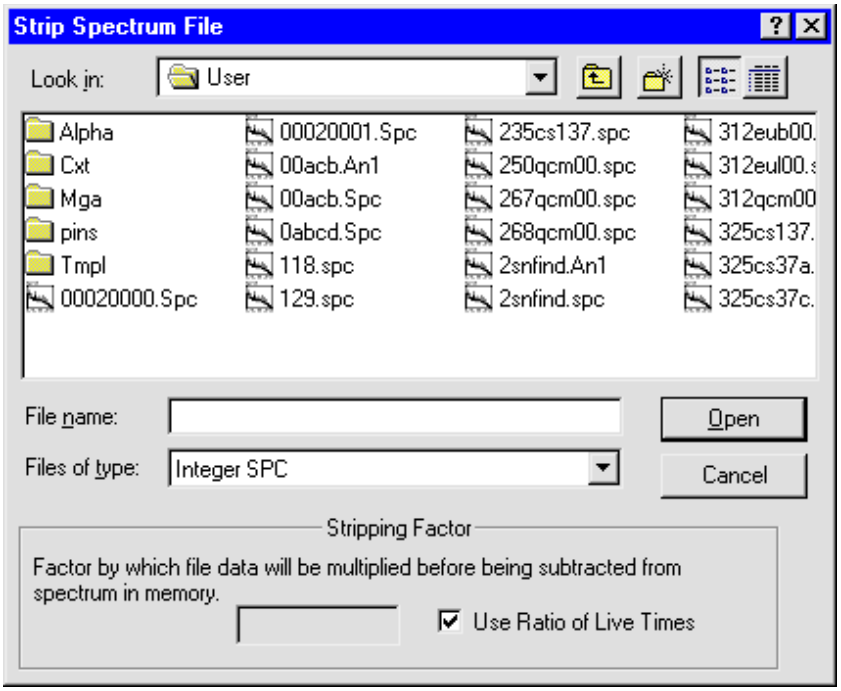


Fig. 119. Strip Dialog.

subtracted from the base spectrum. If the **Use Ratio of Live Times** box is checked, the stripping factor is calculated as the ratio of the live time of the base spectrum divided by the live time of the disk spectrum. The factor can be negative, in which case the spectra are added.

NOTE The live times and real times are not altered by any strip operation. The peak uncertainty (see Chapter 6, "Analysis Methods") will not include the stripped areas and might not represent the true uncertainty.

5.5. Analyze

The **Analyze** menu is shown in Fig. 120. It allows you to define sample, report, and analysis options; analyze spectra on disk; and analyze all or part of a spectrum in Detector memory. The features on this menu, including the command for analyzing a spectrum on disk, are available only when at least one spectrum window is open (therefore, recall a disk file or access a Detector).

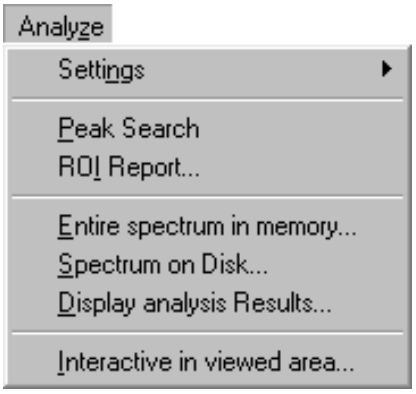


Fig. 120. Analyze Menu.

5.5.1. Settings

This command opens the submenu shown in Fig. 121, which allows you to define the analysis parameters for different sample types, add to and maintain the attenuation correction database, and create and maintain Peak Background Correction (`.PBC`) files.

5.5.1.1. Sample Type...

This opens the Analysis Options dialog, which has five tabs, Sample, System, Report, Options, and Corrections. The fields on this set of screens define a complete set of ScintiVision analysis settings. Once defined, they can be saved to a Sample Description (`.SVD`) file. This `.SVD` file can then be used in `.JOB` files, the **Ask on Start** dialog, the QA analysis, and other places within ScintiVision.

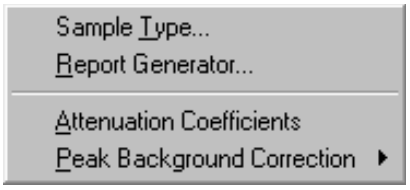


Fig. 121. The Settings Submenu.

To create an `.SVD` file, complete all five screens of the dialog, then return to the Sample tab. Click on the **Save As...** button in the upper right of the dialog. This will open a standard file-save dialog. Enter the path and new filename, then click on **OK** to return to the Sample tab. Click again on **OK** to close Analysis Options.

NOTE This settings dialog applies ***to the active Detector only***. Each Detector must be selected and its settings changed individually.

Sample Tab

Sample settings (Fig. 122) are those for which values are generally different for each sample type. When an `.SVD` file is recalled, the date of **Creation** and last date the file was updated (**Edition**) are displayed.

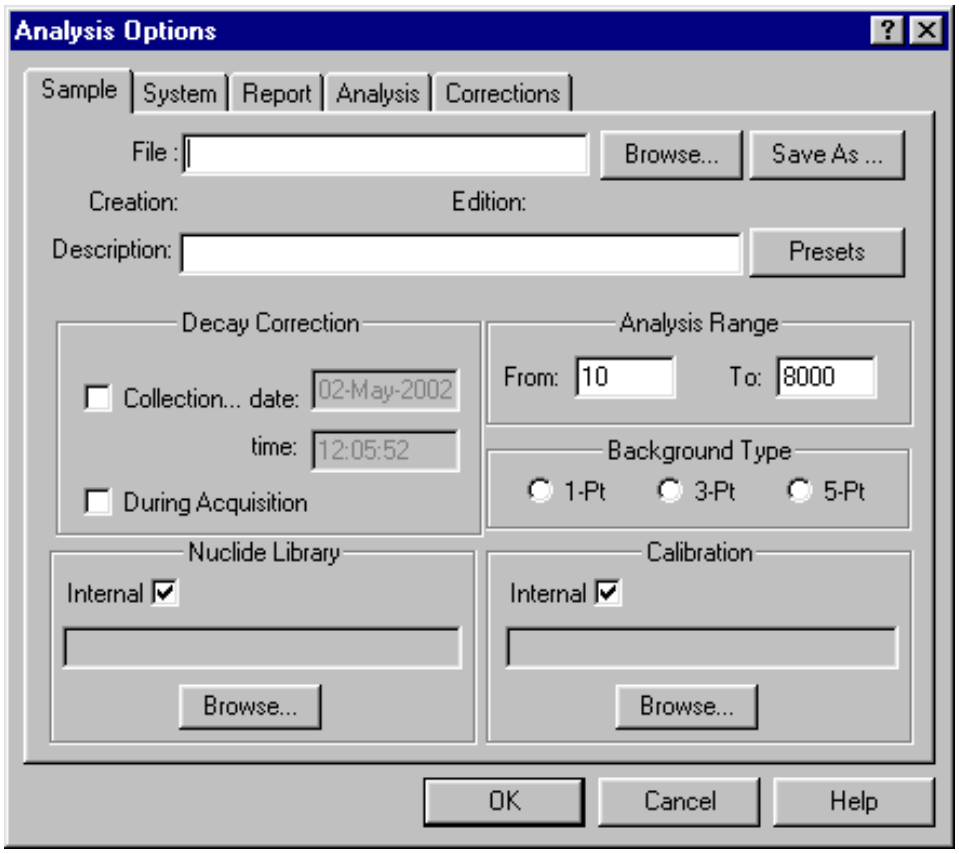


Fig. 122. The Sample Tab.

The **Description** is used to identify the sample-type file and can be 64 characters long.

Mark the check boxes in the **Decay Correction** section to enable or disable decay correction **During Acquisition** and decay correction to a given **date:** and **time:**. Both of these affect the report of the analysis of the total spectrum. The **Collection date** and **time** can also be entered under **Acquire/Acquisition Settings...**.

Clicking on the **Presets** button opens the Presets dialog for the selected Detector (see the Detector's corresponding entry in Section 5.2.10 or the *ORTEC MCB CONNECTIONS-32 Hardware Property Dialogs Manual*) so you can enter the values to be used as defaults in the **Acquire/Acquisition Settings...** dialog. (Remember that these presets are used as the defaults if the appropriate **Ask on Start** box is checked under **Acquire/Acquisition Settings...**; see Section 5.2.1 for more information.)

The **Analysis Range**, in channels, can be entered. This is usually used to eliminate analysis of the ends of the spectrum that do not contain useful data.

The **Background Type** can be set to 1-, 3- or 5-point. This is explained in more detail in Chapter 6.

The filename of the **Nuclide Library** to be used in the spectrum analysis can be the **Internal** (working) library or a library on disk. The working library is the library from **Library/Select File...**, and will include *any modifications made during the interactive analysis mode*.

The **Calibration** data to be saved with the spectrum or used for online analysis can be the currently loaded **Internal** (working) calibration or a calibration **File** stored on disk. The working calibration is the calibration just created in the calibration section (see Section 5.3) or the calibration most recently recalled from disk. When the `.SPC` file for this spectrum is saved on disk, the current calibration is saved with it for later analysis. The interactive analysis (**Analyze/Interactive in viewed area**) uses the internal calibration.

NOTE Each Detector and the buffer can have separate calibrations.

System Tab

System settings are those settings that are generally the same from sample to sample (however, all these entries except the **Laboratory** and **Operator** names can be different for each sample type). The dialog is shown in Fig. 123.

The **Laboratory name**, composed of any 64 characters, is printed on the report.

The **Operator name** is the name of the person operating the system. This name will appear on the analysis report. This field defaults to the user name entered during Windows installation.

In the **Library** section, **Match Width** sets the maximum amount (as a fraction of FWHM) by which a peak centroid can deviate from the nearest library peak energy and still be associated with that library peak. If the value is too small, some spectrum peaks will be misidentified due to statistical variation in the centroid, and if it is too large, some library peaks will be incorrectly identified. The default value is 0.5.

Fraction Limit is one of the parameters used to determine the presence or absence of a nuclide. The sum of the emission probabilities of the peaks in the spectrum identified with the nuclide is divided by the sum of the emission probabilities of all peaks of the nuclide in the energy range being analyzed. If the result is greater than the fraction limit, the nuclide is marked as being present. See Section 6.4.2.

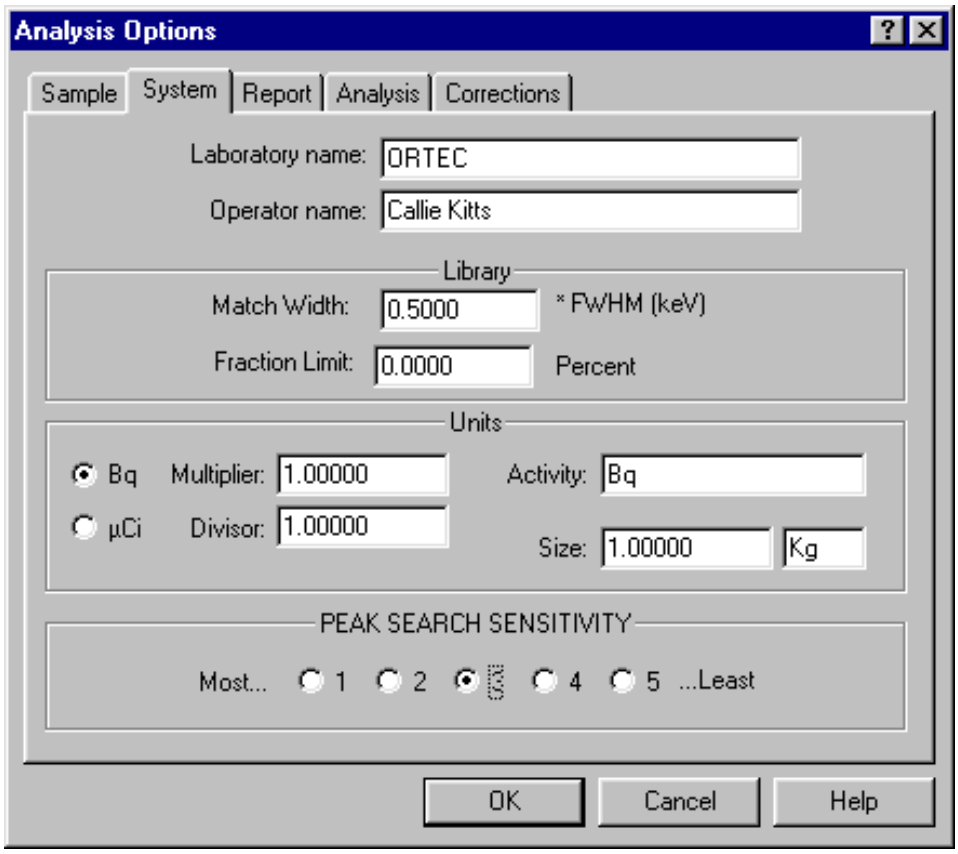


Fig. 123. The System Tab.

The **Units** section allows you to select either becquerels (**Bq**) or microcuries (**µCi**) as the base units, and a **Multiplier** and **Divisor** to scale the numbers up or down. The units label is printed at the top of the activity columns on the report and should reflect the values chosen; that is, if **µCi** is chosen with a multiplier of 1000, then nanocuries should be entered in the **Activity** field. If the sample quantity is entered later (see **Acquire/Acquisition Settings...** or **File/Settings...**), the units for quantity (weight or volume) are entered in the **Weight** field. The combined label (activity/quantity) is limited to 14 characters.

The **PEAK SEARCH SENSITIVITY** sets the sensitivity for the peak search used in the **Interactive in viewed area** (Section 5.5.5) and **Entire spectrum in memory...** analyses (Section 5.5.2). The sensitivity can be set at any integer value from 1 to 5, with 1 being the most sensitive (that is, “1" finds the most peaks). A value of 1 will find small peaks, but will also “find” many false peaks. A value of 5 will locate all the large peaks, but could miss some of the smaller peaks. If the value is too sensitive, many regions will be deconvoluted unnecessarily in the interactive mode. A starting value of **3** is recommended.

Report Tab

This screen (Fig. 124) controls the contents, destination, and some details of the output report.

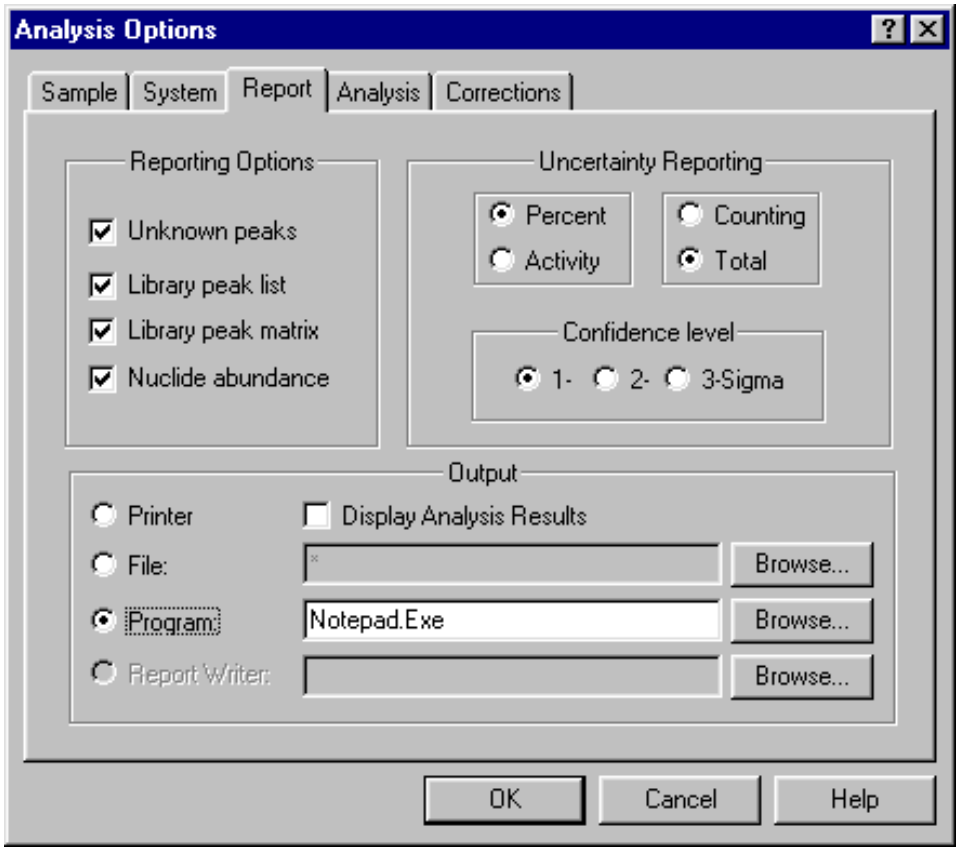


Fig. 124. Report Tab.

Select one or more **Reporting Options.** If it is not possible for all the requested options to be printed because information is lacking, ScintiVision might print another option if there is enough information for it. For example, suppose a nuclide activity report is the only report option selected. If the spectrum has not been efficiency calibrated, the activities cannot be calculated. In this case, ScintiVision will instead print the library peak list because there is sufficient information to do that.

Next, choose the **Uncertainty Reporting** options. The **Confidence level** multiplier shown here is used *on the report only*. All internal checks on peak uncertainty are done at the 1-sigma level. See Chapter 6 for details on the total uncertainty calculation. The uncertainty can be in **Activity** (e.g., 200 Bq ± 10 Bq) or **Percent** (e.g., 200 Bq ± 5%). If **Counting** is selected, counting uncertainty will be printed. If **Total** is selected, both the counting and total uncertainty will be printed.

When ScintiVision performs an analysis, it simultaneously writes the results to a `.UFO` file and an ASCII-format `.RPT` file, each assigned the spectrum filename. Use the **Output** section of the

Report tab to send the appropriate results file to any Windows-supported **Printer** available to the PC, a disk **File**, a **Program**, or the optional ScintiVision **Report Writer**.

When **Printer** is selected, the **`.RPT`** file is spooled to the default Windows printer for this PC.

When **File** is selected, you can specify a new or existing filename; click on **Browse...** and select an existing file to overwrite with the new output data; or leave the default asterisk (*****) in the filename field. In this case, the report filename will remain the spectrum filename with the extension **`.RPT`**.

When **Program** is selected, you can select any 32-bit Windows program to be run with the report filename as an argument on the command line. The report filename sent to the program is the spectrum filename with the extension **`.RPT`**. The default program is Windows Notepad, **`Notepad.exe`**. In this case, when the analysis finishes, Notepad automatically starts, and opens the **`.RPT`** file. (You can also use Notepad to save the **`.RPT`** file to a different filename if desired or print the report) The analysis is not complete until you close the selected program.

The **Report Writer** radio button is only active if the ScintiVision Report Writer (A46-B32) is installed. The Report Writer uses an Access database and Seagate® Crystal Reports® to produce the desired report. Click on **Browse...** to select the report template to be used (see the ScintiVision Report Writer's user manual for a complete discussion of templates).

Analysis Tab

Use this screen (Fig. 125) to select the **Analysis Method** options. The actual analysis is done by a separate program referred to as an *analysis engine*. The analysis engine for the normal analysis is **`GSA Analysis`**. ScintiVision also accommodates user-supplied analysis engines. The program must be able to read the spectrum name from the command line. There are no other restrictions, but if the program does not produce a results file in the **`.UFO`** format, the display results functions and the ScintiVision Report Writer database will not work. All the analysis options can be taken from the **`.SPC`** file. The analysis program should also produce an ASCII **`.RPT`** file so the report can be printed on Windows-supported devices.

In the **Analysis** section, the **Decay Limit** is used to determine the presence or absence of a nuclide. If a spectrum is being analyzed with the decay correction, nuclides that have decayed more half lives than the decay limit are marked as absent, whether the peaks are found or not.

The **MDA Factor** determines the total width of the region to be used to calculate the background variance if the peak is not detected. The region high and low limits are (0.5 × *MDA Factor* × *FWHM*) above and below the peak centroid energy.

The **FWHM Variation** applies to the initial uncertainty in the peak FWHM values. Typically, a setting of 50% will allow the peak widths to vary enough to give a good fit. If a spectrum has been well calibrated, the FWHM variation can be set to 10%. Setting the variation too small will sometimes result in single peaks being fitted as doublets.

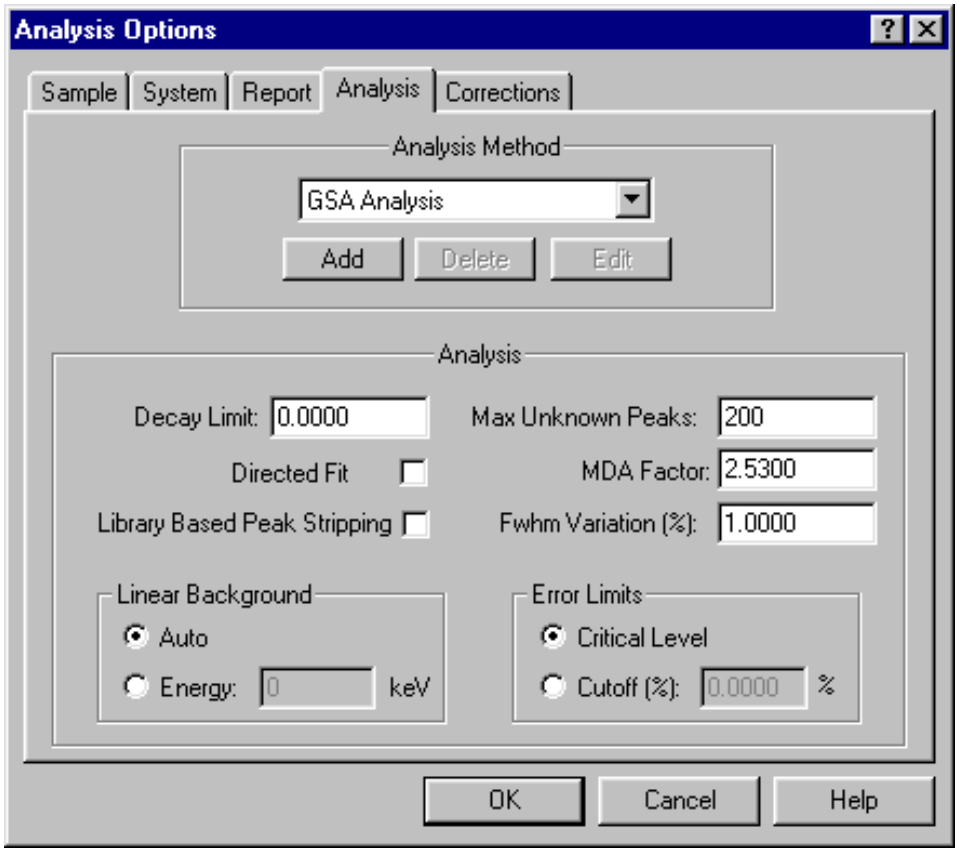


Fig. 125. Analysis Tab.

For **Directed Fit** analysis of NaI spectra, we recommend that you use as small a library as possible. Whenever a directed-fit analysis yields a peak with a large negative area, run **Analyze/Display Analysis Results...** and examine the results. See the discussion of directed fit in Section 6.2.2.2.

The best type of background to use in a fit varies with the type of spectrum. The **Linear Background** energy is the value at which the background under a peak changes from a curve to a straight line. If **Auto** is selected, the program determines the best fit for the background at all energies. In the case where a multiplet is spread over a large portion of the spectrum with the peaks overlapping by only a few channels, the background should be fitted as a polynomial even if it is very flat. If **Energy** is selected, enter the energy at which the background flattens out. Above this energy, the background of a multiplet is fit as a straight line, with a step added under each peak. Below, the background of both singlets and multiplets is fitted as a polynomial.

Error Limits — In ScintiVision, if a peak fails a statistical test, the peak is identified (labeled) in the report, but its value is not used in determining the amount of that nuclide present. You can select either the **Critical Level** or enter a **Cutoff (%)**.

For the **Critical Level,** the cutoff value is software-calculated at:

$$2.33 \times \sqrt{Background\ Variance}$$

and the peak area must be greater than this value in order to be included.

If using **Cutoff (%)**, enter the percent uncertainty for the cutoff. A peak with counting uncertainty greater than the cutoff will be rejected.

Corrections Tab

The Corrections tab is shown in Fig. 126.

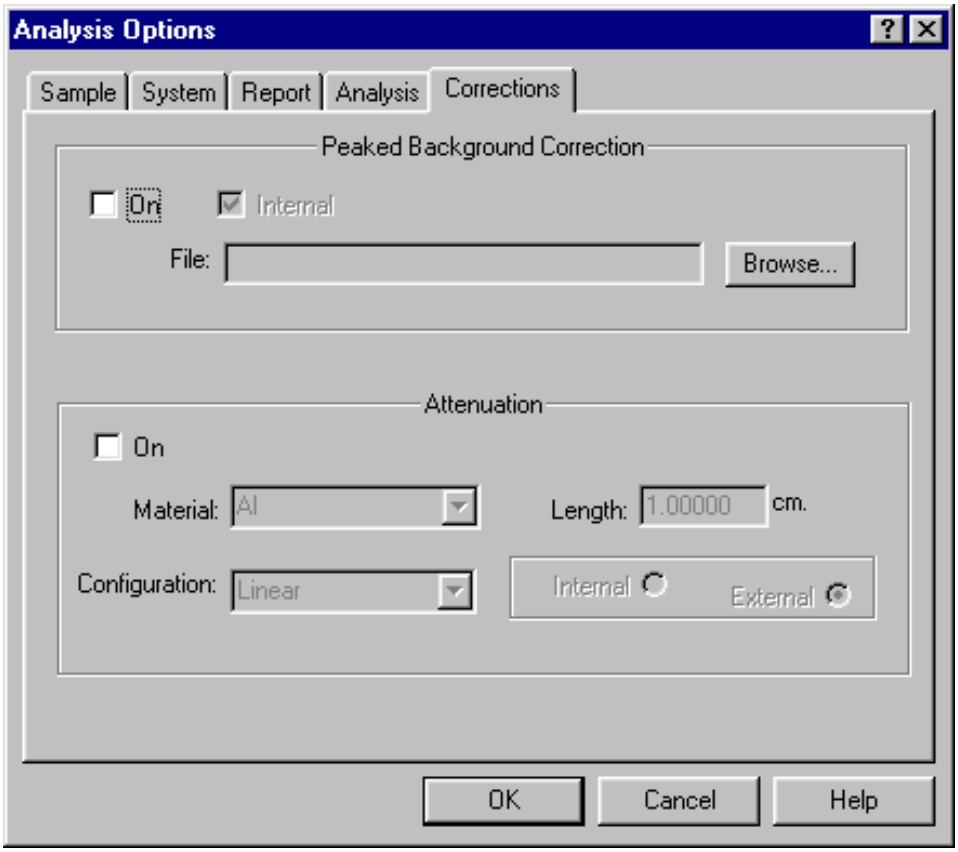


Fig. 126. The Corrections Tab.

The **Peaked Background Correction** can be turned **On** or off, and the correction file can be specified. The filename of the **`.PBC`** file to be used for the correction in the spectrum analysis can

be the **Internal** (working) file or a **File** on disk. If the **Internal** box is not checked, a filename must be entered. The working file is the one loaded with **Analyze/Settings/Peak Background Correction/Select PBC...** (which is discussed beginning on page 130). The correction is explained in detail in Chapter 6.

5.5.1.2. Attenuation Coefficients

This command lets you add to, modify, and view the absorption correction database. The attenuation database supplied with ScintiVision has many common materials already defined.

There are two ways to add new materials to this database:

- Define a new material that is composed of two or more materials already in the database. ScintiVision will then calculate the new attenuation curve from the existing attenuation data.

- Define a completely new material, that is, one not composed of materials in the database. In this case, you will enter the attenuation data in the Attenuation Worksheet sidebar, and save the new material and its attenuation data it to the database.

Selecting **Coefficient Table** opens the Attenuation Worksheet Sidebar, Attenuation Table, and Attenuation graph window, as illustrated in Fig. 127.

To select an absorber from the Attenuation Worksheet, click on the down-arrow button in the **Absorber** section to display the list of materials in the database, and click on the desired entry. Selecting a material loads the attenuation values and redisplays the Attenuation Table and graph. Clicking the mouse on a the table values moves the marker to that energy in both the Attenuation graph window and spectrum windows. Clicking the mouse in either spectrum window or the Attenuation graph window moves the marker to that energy in the other plots. The attenuation value is displayed on the Marker Information Line.

Adding a Material Composed of Substances Already in the Database

ScintiVision makes it easy to add a new absorber made of substances already in the absorber database. The new absorber can be a chemical compound such as sodium iodide (NaI), or a more complex mixture, such as sand and lead.

1. In the **Attenuation** section of the sidebar, click on either the **Mass** or **Linear** radio button.

2. Click on **Add**. This will open the Absorber Definition dialog (Fig. 128).

3. Enter the **Name** of the new material. As an example, we will use **NaI**.

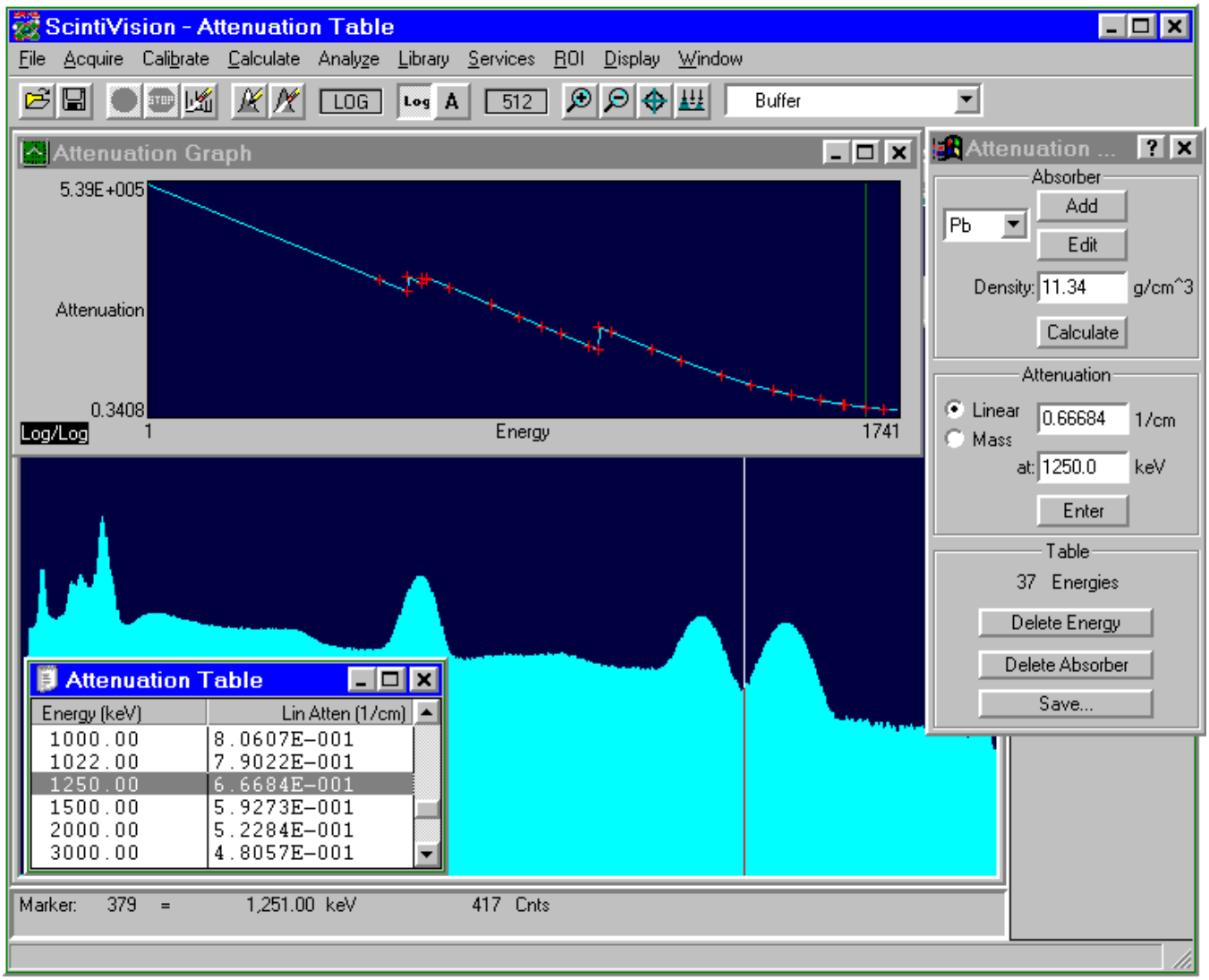


Fig. 127. Attenuation Worksheet Table for Absorber Coefficient Table.

4. Next, decide whether to describe the ratio of components in the material as *a percentage* or a *mass ratio*; this will determine which radio button should be marked in the **Units** section of the Absorber Definition dialog.

   - If you know the relative number of atoms (or molecules) of each constituent in the absorber — for example, NaI — click on **%**. Amounts entered are multiplied by the atomic weight of the constituent and normalized to 100%.

   - Click on **Mass Ratio** if you know the relative amounts of constituents by weight — for example, 90% sand, 10% lead.

5. NaI contains sodium and iodine in a 1-to-1 ratio. Therefore, it should be entered in the Absorber Definition dialog as two separate **Constituent**s, Na and I, each in the relative

Amount of 1. (Similarly, Al_20_3 would be entered as aluminum in the amount of 2, and oxygen in the amount of 3.)

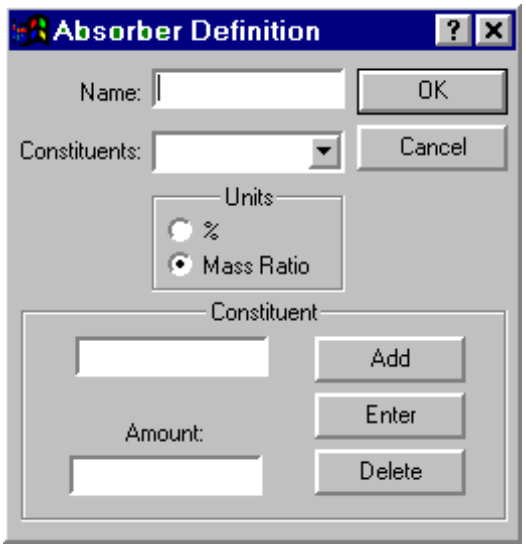


Fig. 128. The Absorber Definition Dialog.

- In the **Constituent** section, enter Na and an amount of 1, then click on **Add**. The **Constituent** droplist in the upper part of the dialog will now list Na as a component of NaI (Fig. 129). (Clicking on **Add** twice for the same constituent will add it to the list twice.)

- Return to the **Constituent** section, enter I and an amount of 1, then click on **Add**. The droplist at the top of the dialog will now show both components.

- Click on **OK** to close the Absorber Definition dialog.

The new material's name will now be displayed in gray on the sidebar **Absorber** drop list.

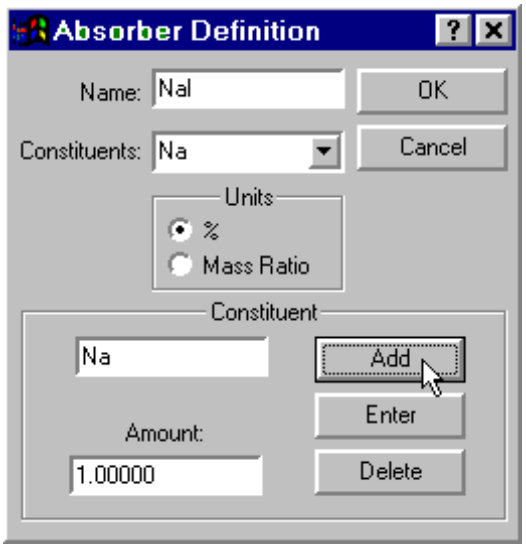


Fig. 129. Defining a New Absorber: Adding the First Component of Sodium Iodide.

NOTE If you choose **Mass Ratio** instead of **%**, the ratios of the masses must be entered and must total 1.00. For example, the atomic mass of NaI is 149.89, so the Na mass ratio is **0.153** (= 22.989/149.89) and the I mass ratio is **0.847** (= 126.90/149.89). If an absorber has only one constituent, the mass ratio is **1.00**.

6. If you clicked on **Mass** in step (2), the **Absorber** section of the sidebar will contain a field labeled **Density**; density values can be found in various reference books. (For example, the density of NaI is 3.67 g/cm^3.). If you clicked on **Linear** in step (2), this field will instead be labeled **Mass**; enter the atomic mass units for the total compound or element. (The atomic mass for NaI is 149.89 [= 22.9897+126.904].) Enter the **Density** or **Mass**.

7. Click on **Calculate**. If the database contains attenuation data for all of the components in the new material, the Attenuation Table of coefficients will be displayed. Otherwise, a "**Check the mass attenuation data list for missing elements**" message will be displayed.

8. Click on the **Constituents** droplist and check spelling and spacing against the Worksheet's droplist. To correct an entry, click on it to load it into the bottom section of the Absorber Definition dialog, make the corrections, click on **Enter**, then click on **OK** to close the dialog. Return to the Attenuation Worksheet and click again on **Calculate**.

9. Once the new absorber's attenuation coefficients have been calculated, the final step is to either save the new absorber to the database (click on **Save...** at the bottom of the sidebar) or delete the new entry (**Delete Absorber**). If you save it, the absorber list at the top of the Worksheet will become active, and will now list your new material.

10. To close the **Attenuation Coefficient** feature, including Worksheet, table, and graph, click on the Worksheet's × box.

NOTE The **Linear** and **Mass** attenuations are stored separately in the database. If you wish to use both, *each must be added, calculated, and saved*.

Editing or Deleting the Constituents in an Absorber

Suppose that in our example we used an incorrect chemical formula for sodium iodide, Na_2I instead of NaI, and now wish to correct the error. To do this:

1. On the Attenuation Worksheet sidebar, select **NaI(Tl)** from the **Absorber** drop list, then click on **Edit**. This will open the **Absorber Definition** dialog.

2. Click on the **Constituents** drop list at the top of the dialog, and select **Na**. The fields at the bottom of the dialog will now display **Na** as the **Constituent**, in the **Amount** of **2**. Change the amount to **1** and click on **Enter**.

3. To delete a component from an absorber, select it from the **Constituent** drop list and click on **Delete**. (This **Delete** button does not remove an absorber from the database, just changes the absorber's composition. To completely remove an absorber, close this dialog, go to the bottom of the sidebar, and click on **Delete Absorber**.)
4. Click on **OK** to close the Absorber Definition dialog.

5. Next, enter the mass or density as shown in the **Absorber** section at the top of the sidebar and click on **Calculate**.

6. Click on **Save** to store the complete record in the database.

Adding a New Element or Single-Constituent Material to the Database

Adding a new material involves (1) defining the absorber name, then (2) using the Attenuation Worksheet sidebar to create the corresponding table of attenuation coefficients. To do this you will need enough energy/attenuation pairs to generate a good attenuation function. These values can be found in reference books.

1. If the attenuation values are in g/cm^2, click on the **Mass** radio button in the **Attenuation** section of the sidebar. If the attenuation values are in units of 1/cm, click on **Linear**. Either method can be used in simple cases, however, if you expect to use the materials entered here in creating absorber files for compounds, **Mass** must be used.

2. On the sidebar, click on **Add** to open the Absorber Definition dialog.

3. In the **Name** field, enter the chemical symbol for the element (or substance name) — for example, **Co**.

4. In the **Constituent** section, enter **Co** and an **Amount** of 1.0, then click on **OK** to close the dialog and return to the sidebar.

5. Now, in the **Attenuation** section of the sidebar (Fig. 130), enter the energy/attenuation pairs for as many energies as necessary to obtain a good attenuation function. When entering the X-ray edge, use energy values that are close but not equal, e.g., 13.420 and 13.421 keV.

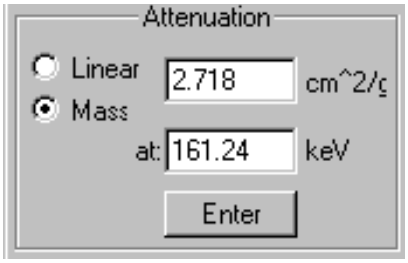


Fig. 130. Adding a New Constituent to the Database.

6. Click on the **Save** button at the bottom of the sidebar to store the table.

7. Next, enter the mass or density as shown in the **Absorber** section at the top of the sidebar (Fig. 127), and click on **Calculate**.

8. Click on **Save** again to store the complete record in the database.

5.5.1.3. Peak Background Correction

The **Peak Background Correction** submenu is shown in Fig. 131. Use these commands to load a new working `.PBC` file, and to create or edit `.PBC` files. The `.PBC` files are organized by nuclide, then by peaks, for each nuclide.

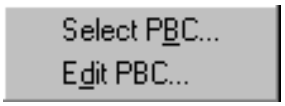


Fig. 131. PBC Menu.

The PBC table file is used with the Peak Background Correction in the spectrum analysis. Note that the PBC correction is related to the detector and the shield, but not to the geometry of the sample. Any of the correction table nuclide data include the nuclide name, which can be any combination of eight characters, but must be consistent throughout all files.

At startup, ScintiVision automatically attempts to load the PBC table last loaded. Thereafter, it can be replaced at any time using **Select PBC...**. It stays resident in memory after it have been loaded.

Select PBC...

Use this command to open a standard file-open dialog (Fig. 132) and select a new working `.PBC` file. If a `.PBC` file is already loaded, its name will be displayed in the **File name:** field; otherwise, the default, `*.PBC`, will be shown. Select the desired file and click on **Open**.

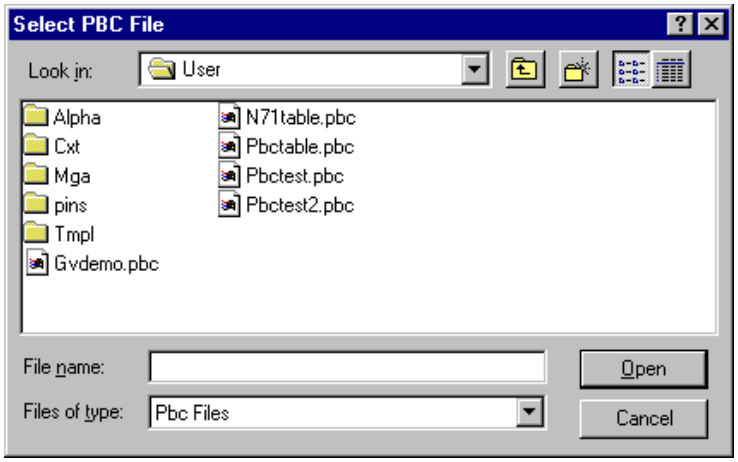


Fig. 132. Select PBC File.

Edit PBC...

This function is used to create a new `.PBC` file or to change the contents of an existing `.PBC` file. To create a `.PBC` file, click on **Edit PBC...** to open the **Editing:** dialog shown in Fig. 133.

Figure 134 shows this dialog's control menu (click on the Title Bar icon to open it). It contains several of the commands necessary to create and edit `.PBC` files.

Manually Creating a New PBC Table

Open the control menu and click on **New**. This will clear the **Edit** window so nuclides can be entered manually. Click on the **Insert...** button to open the dialog shown in Fig. 135. *Enter the nuclide name exactly as it appears in the library*.

Now, in the (right-hand) peak portion of the dialog, click on **Insert...** to open the dialog in Fig. 136. Enter the energy of the gamma ray and the counts per second of the background peak. *The energy must be the same as the library value*. Peak energies in the PBC Table and not in the library for this nuclide will not be corrected, and peak energies in the library and not in the PBC Table for this nuclide will not be corrected.

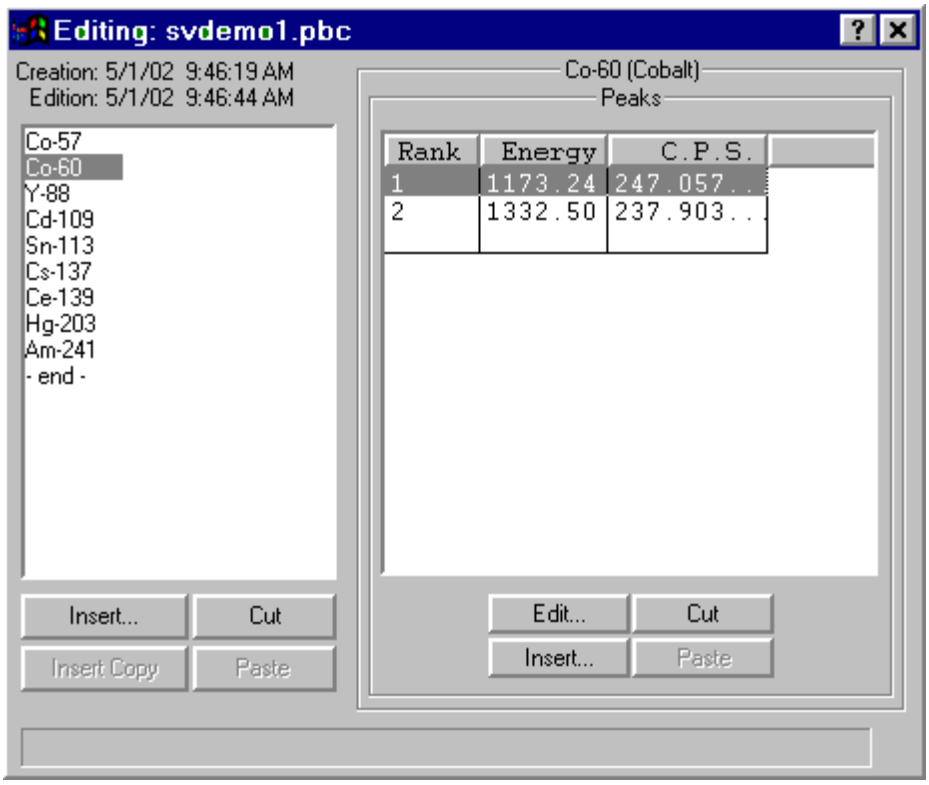


Fig. 133. PBC Table Editing Dialog.

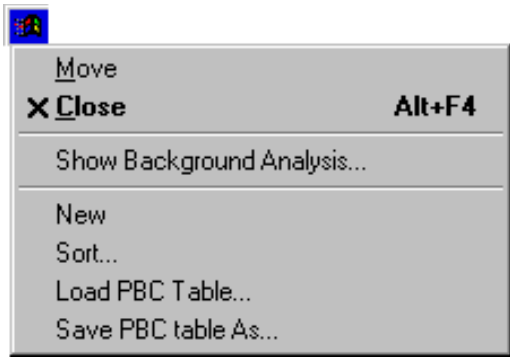


Fig. 134. Edit PBC Dialog Control Menu.

Automatically Creating a PBC Table

To make a `.PBC` file from the background spectrum analysis results (`.UFO`) file, the background count rates are extracted from the analysis results file and inserted in a `.PBC` file. To do this, open the control menu and click on **Show Background Analysis...**. This will open a standard file-open dialog. Select the correct `.UFO` file and click on **Open**. The list of nuclides in the

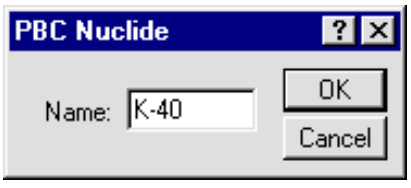


Fig. 135. Edit or Manually Add Nuclide Name.

analysis will be displayed to the left of the PBC Table (see Fig. 137). If no peaks are shown, none were in the analysis file, possibly because they were all outside the energy analysis range.

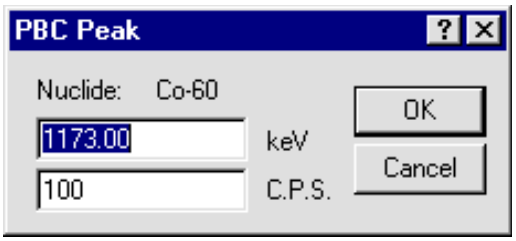


Fig. 136. Edit PBC Peak Values.

Adding Nuclides

There are two **Insert** buttons at the bottom of the PBC nuclide list: **Insert...**, which is for manually specifying the nuclide; and the button below it, which will be labeled with the name of the nuclide selected in the analysis results list (when no nuclide is selected, this button is labeled **Insert Copy**).

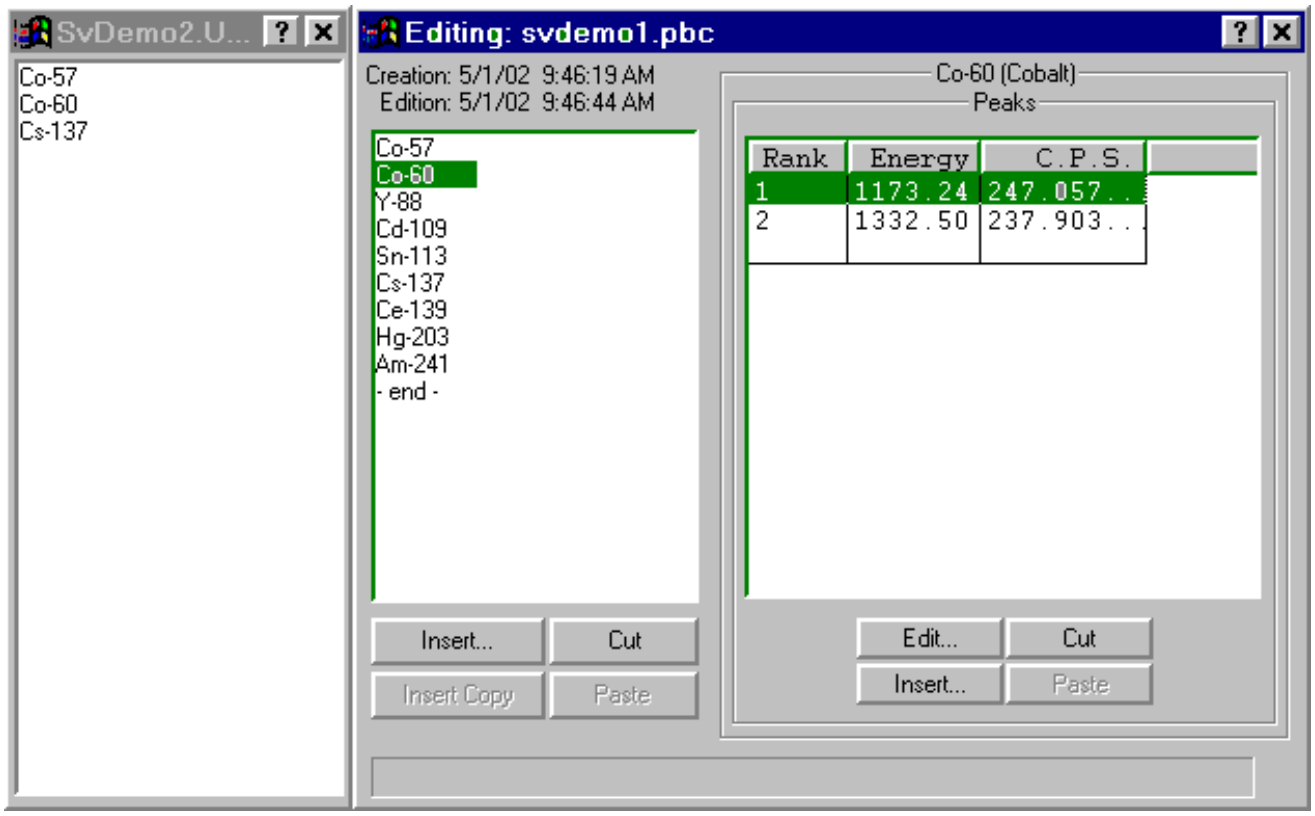


Fig. 137. The List of Analysis Nuclides (left) and the PBC Table (right).

To automatically add an analysis nuclide to the PBC list: Go to the analysis results list and click once on the nuclide of interest. This will activate the gray **Insert Copy** button at the bottom of the PBC list, and change its label to **Insert** plus the name of the nuclide. Now, in the PBC list, locate the nuclide immediately *below* the desired insertion position, then click on **Insert [nuclide name]**. This will insert the nuclide, and display the energies and backgrounds for its peaks in the analysis.

Double-clicking on a nuclide in the analysis results list will insert it into the PBC list immediately above the highlighted PBC-list nuclide.

To manually add a nuclide to the PBC list, locate the nuclide immediately *below* the desired insertion position, and click once to highlight it. Next, click on the manual **Insert...** button to open the dialog shown in Fig. 135, then follow the manual nuclide and peak insertion instructions that begin on page 130.

The entire analysis nuclide list can be copied to the PBC list by opening the analysis list's control menu (Fig. 138) and selecting **Copy All to PBC**.

Fig. 138. Analysis Results List Control Menu.

To change the name of a nuclide on the PBC list, double-click on it to open the PBC Nuclide dialog (Fig. 135).

To remove a nuclide from the PBC list, click on the nuclide, then on **Cut**. This will remove the nuclide from the list. In addition, it will activate the gray **Paste** button at the bottom of the PBC list, and change its label to include the name of the cut nuclide. This is illustrated for ^{152}Eu in Fig. 139.

Rearranging a PBC List

Nuclides can be rearranged in the **`.PBC`** file list by cutting and pasting them into a different location. To move a nuclide to a new position in the list, highlight the nuclide to be moved; **Cut** it from the list; locate the nuclide immediately *below* the desired new position and click once on that nuclide to highlight it; then click on the **Paste** button (which will be labeled with the name of the **Cut** nuclide). The **Cut** nuclide will be inserted in the space above the highlighted nuclide.

Fig. 139. Cut Nuclide is Ready to Paste.

Several nuclides can be cut at one time from the list, then pasted back into the list into a different order. Cut nuclides remain queued up for pasting, last one first, according to the nuclide name on the **Paste** button.

To move a nuclide to the end of the PBC list, **Cut** the nuclide from the list, highlight the **--end--** entry, and click on the **Paste** button**.**

Peak Editing

When a nuclide is selected in the working **`.PBC`** file, the right half of the Edit PBC dialog shows the peak list. Note the column headers, **Rank**, **Energy**, and **C.P.S.**. To sort the peak list by a particular parameter in the list, click on the appropriate header.

To edit a peak, either double-click on the peak in the right-hand list, or click once on it, then click on the **Edit** button. This will open the PBC Peak dialog (Fig. 136).

Use the same PBC Peak dialog to add a peak: click on the peak *just below* the desired insertion point in the peak list, then click on **Insert...**. This will open the PBC Peak dialog. Enter the energy and counts for the peak and click on **OK**.

Peaks can be deleted with **Cut** and moved with **Cut/Paste**. The order of the peaks is not important and has no effect on the correction.

Several peaks can be cut at one time from the list, then pasted back into the list into a different order. Cut peaks remain queued up for pasting, last one first. Each relocated peak will be assigned a **Rank** number according to its new position. Click on the peak *just below* the desired insertion point in the peak list, then click on **Paste**.

Saving or Canceling Changes and Closing the Edit Session

To save this modified **`.PBC`** file and use it as the working file, click on the control menu, then **Save PBC Table As...**. Either use the current filename (which will overwrite the previous values) or assign a new filename, then click on **Save**. (ScintiVision will assign the default **`.PBC`** extension.) To exit the edit session, click on the control menu, then **Close**.

To abandon any changes and restore the **`.PBC`** file to its condition before editing, click on the control menu, then **Close**. A dialog will open asking if you want to save the changes; select **No**.

5.5.2. Entire Spectrum in Memory...

This selection initiates an analysis of the entire spectrum, generating **`.RPT`**, **`.UFO`**, and **`.AN1`** files. When the analysis completes, the report is generated. The drive, path, and **`.UFO`** filename are displayed at the bottom of the screen. The **`.AN1`** file contains the spectrum, acquisition information, and current calibration and analysis parameters.

If the **Program** radio button on the Report tab of **Analyze/Settings/Sample Type...** has been selected, with **`Notepad.exe`** designated as the output program, ScintiVision will open Windows Notepad and display the analysis report. The software will not do another analysis while the report display is shown. When you exit Notepad, control will return to ScintiVision.

5.5.3. Spectrum on Disk...

This starts the analysis of a spectrum currently stored on disk. A dialog box of spectrum names opens (Fig. 140). The analysis starts as soon as the filename is selected. The analysis parameters used in the analysis are the parameters stored in the spectrum file. The analysis is performed in the background, generating a `.UFO` and an `.RPT` file. When the analysis is complete a message is displayed on the information line.

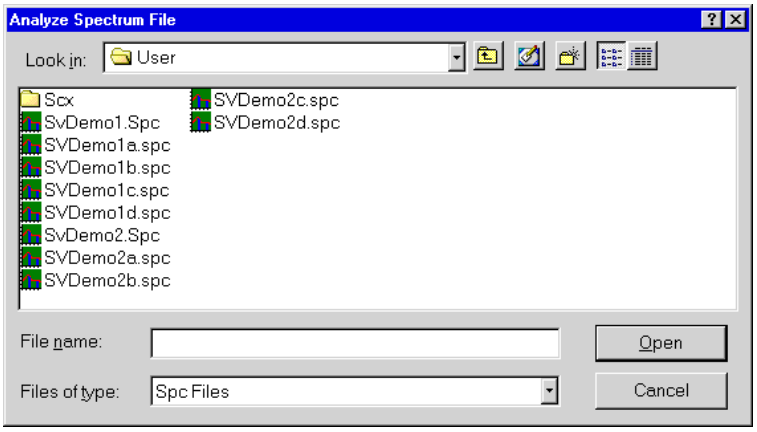


Fig. 140. Choose a Spectrum File to Analyze.

If the **Program** radio button on the Report tab of **Analyze/Settings/Sample Type...** has been selected, with `Notepad.exe` designated as the output program, ScintiVision will open Windows Notepad and display the analysis report. Close Notepad to end the analysis session and return to ScintiVision.

5.5.4. Display Analysis Results...

This command displays the results of an analysis of the complete spectrum by reading the analysis results stored in a `.UFO` file (the `.UFO` file selection dialog is shown in Fig. 141). This differs from the interactive analysis results in that this analysis considers all of the spectrum and all of the library entries. The `.UFO` files are created by **Analyze/Entire Spectrum in Memory...**, **Analyze/Spectrum on Disk...**, and **Start/Save/Report**.

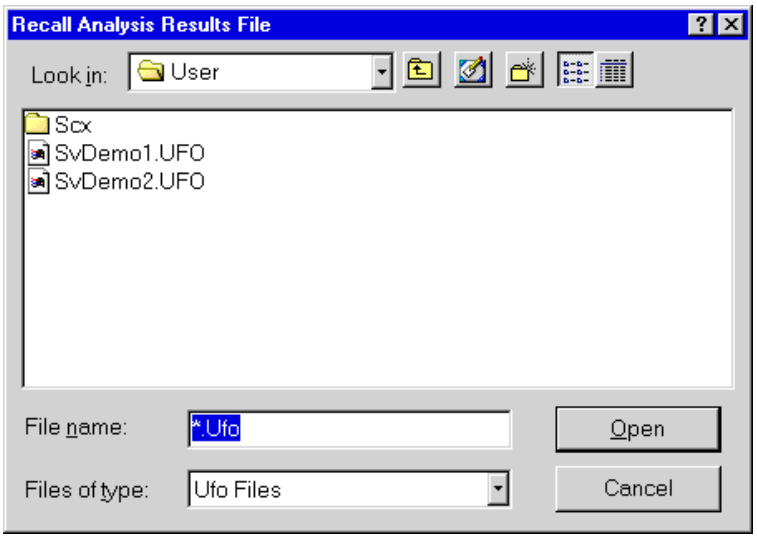


Fig. 141. Open a .UFO File.

Run **Entire Spectrum in Memory...**, then select **Display analysis results**. The results of the just-created `.UFO` file will be displayed immediately.

Figure 142 shows the display for a typical `.UFO` file, along with its spectrum file. Note the Analysis Sidebar on the right of the screen. The buttons move the marker up and down through the results list, library, and spectrum simultaneously.

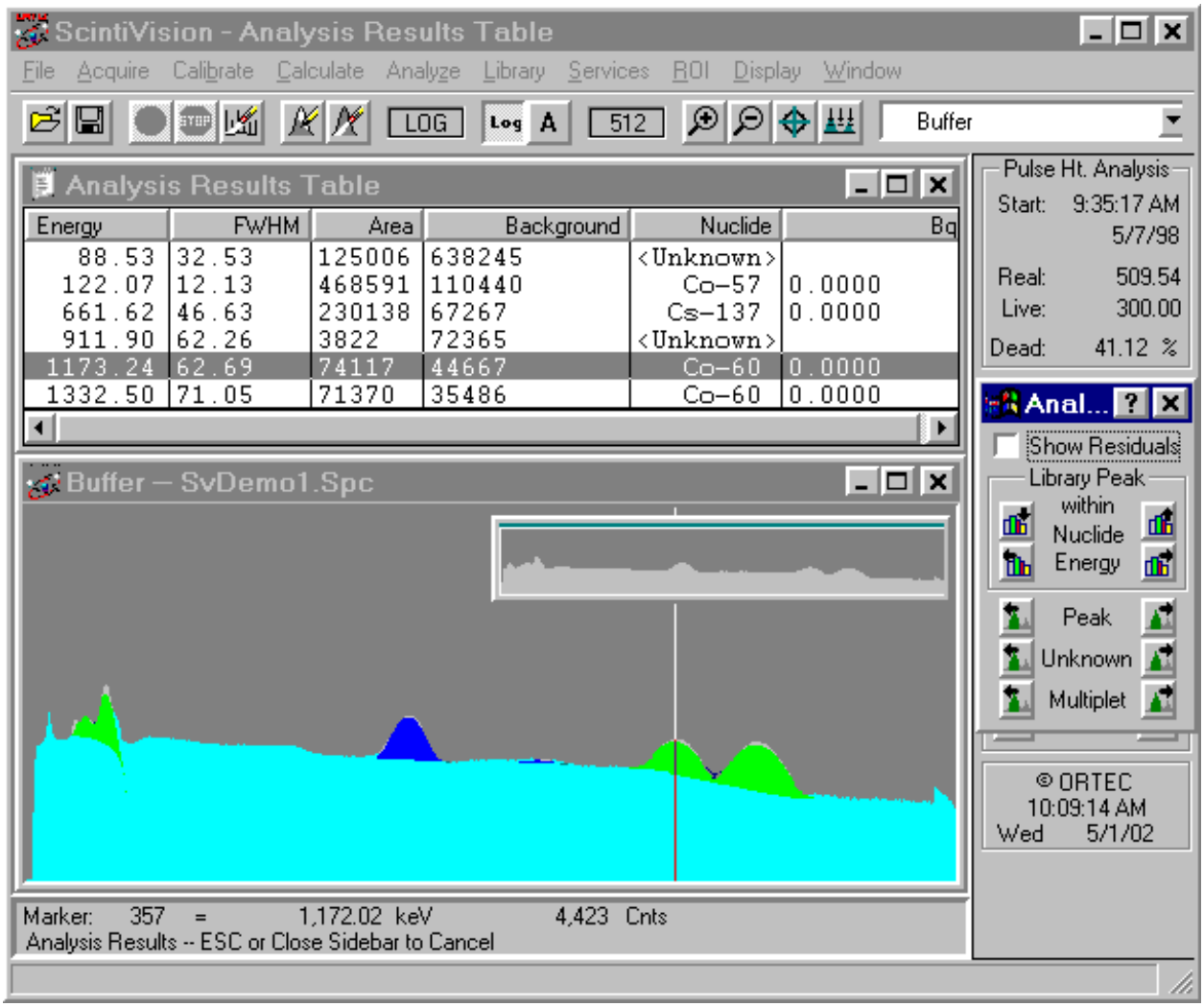


Fig. 142. Display from `.UFO` File.

- The **within Nuclide** buttons move up and down the library list for the selected nuclide, in the order the energies are stored in the library. Since the library energies are not usually stored in increasing energy order, this will cause the marker to jump about the spectrum. This is useful in deciding if a nuclide is present or not, by looking for all the lines associated with the nuclide. If the selected peak has a zero area, it is not displayed.

- The **Energy** buttons move the cursor up and down through the library peak list in energy order. Only non-zero-area peaks are shown. Since the library used for the analysis might not be the same as the working library, this could be a different set of peaks than found with the **Library** buttons on the Status Sidebar.

- The **Peak** buttons move the marker up and down through all the peaks in the spectrum. This includes non-zero-area library peaks and unknown peaks above the peak-search sensitivity cutoff.

- The **Unknown** buttons move the marker up and down through the unknown peaks that satisfy the sensitivity cutoff, in energy order, skipping over any library peaks.

- The **Multiplet** buttons move up and down through the multiplet or deconvoluted regions in the spectrum. The multiplet up button goes to the first (lowest-energy) peak of the next higher multiplet. Similarly, the multiplet down button goes to the last (highest-energy) peak of the next lower multiplet.

To look at individual peaks in the multiplet, use the **Peak**, **Energy**, or **Unknown** buttons.

Marking the **Show Residuals** check box adds a line beneath the spectrum that displays the difference between the actual spectrum and the calculated spectrum based on the analysis and the calibration peak shape. An example, marked with an arrow, is shown in Fig. 143.

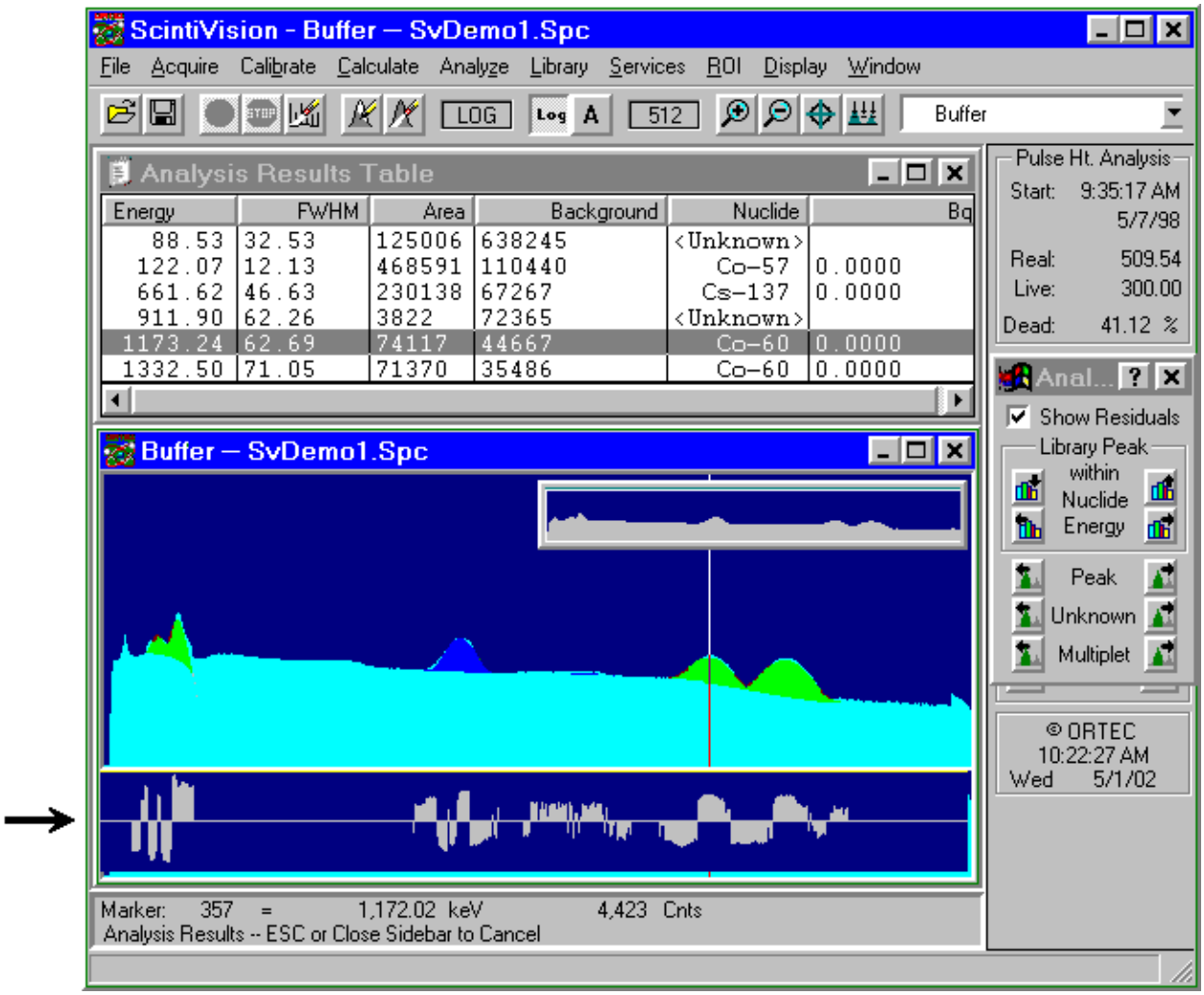


Fig. 143. Spectrum Residuals Display (arrow).

Figure 144 shows the Analysis Results Table window.

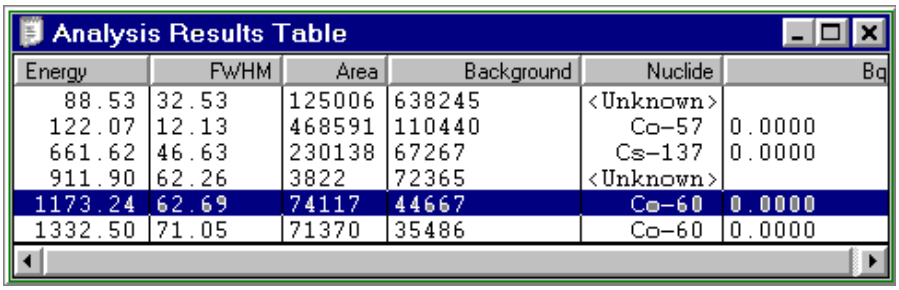


Fig. 144. Analysis Results Table.

The Analysis Sidebar's control menu is shown in Fig. 145 (click the sidebar's icon to open the menu). Mark/unmark **Table** to show/hide the Analysis Results Table. Use **Print** on the results window's control menu to print the table as displayed (note that this is not the same as the complete report described in Chapter 7).

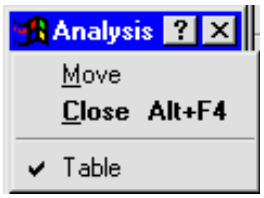


Fig. 145. Analysis Sidebar Control Menu.

When the Analysis Results Table is displayed you can see more details about any peak by double-clicking on its listing in the table. This opens a **Details** window, as shown in Fig. 146.

The **Details** window shows the following peak information, derived from the `.UFO` file structure (which is described in detail in the ORTEC *File Structure Manual*:

Energy — The library peak energy in keV, or the centroid energy for unknown peaks.

EnergyUncertainty — The uncertainty in the energy of the peak as calculated from the fit.

Centroid — The peak centroid energy from the spectrum.

Center — The peak centroid channel from the spectrum.

mlo, mhi — The low and high channel numbers for the peak region. These are the beginning and end channel numbers for the background region around a single peak. See also **multilo, hi**.

multilo, hi — The low and high channel numbers for the multiplet region. These are the beginning and end channel numbers for the background region around the entire multiplet. All peaks in the multiplet will have the same **multilo, hi** values.

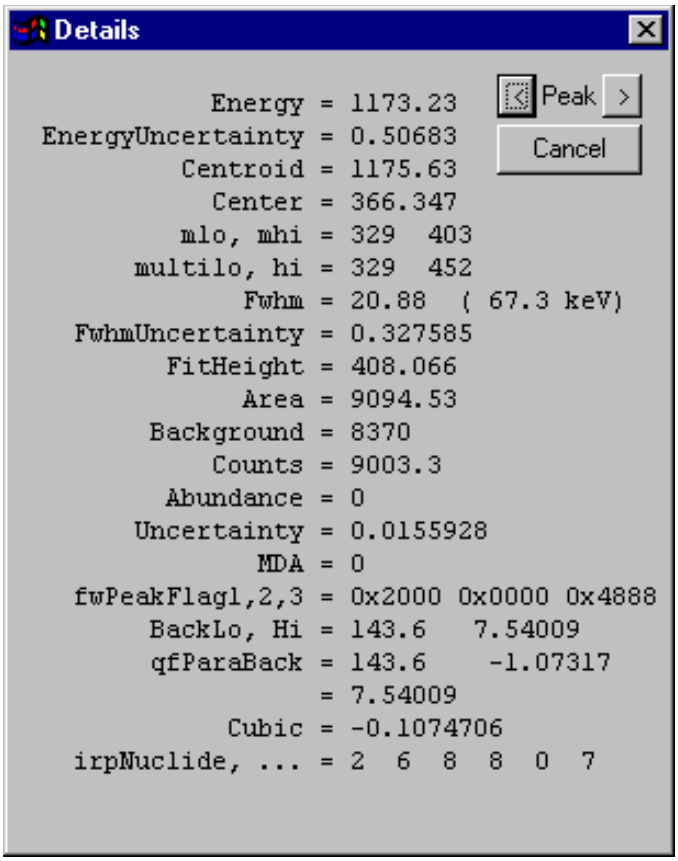


Fig. 146. `.UFO` Peak Record Description.

Fwhm The FWHM of the peak. It is a measured value for single peaks and a calculated value for peaks in a multiplet region.

FwhmUncertainty The uncertainty of the FWHM as determined in the fit.

FitHeight The height of the fitted peak function.

Area The corrected net area of the peak. For example, the PBC correction could be applied to this number.

Background The corrected peak background calculated by the program.

Counts The uncorrected net area of the peak.

Abundance The activity for this nuclide based on this peak only. It is zero for unknown peaks or if there is no efficiency calibration.

Uncertainty The 1-sigma counting uncertainty in the peak net area, as a fraction.

MDA The minimum detectable activity for this nuclide based on this peak only. It is zero for unknown peaks or if there is no efficiency calibration.

fwPeakFlag1,2,3 The peak flags described in the *File Structure Manual* as hexadecimal numbers.

BackLo, Hi The calculated background values used to calculate the background.

SlopeAbove The slope of the background above the peak.

qfParaBack The parabolic factors for calculating the background. If the parabolic background has not been used, these are 0.

Cubic The cubic background value.

irpNuclide, ... The pointers to other records in the `.UFO` file as described in *File Structure Manual*. They are only used in debugging.

To step to the next-highest-energy peak, click on >; for the next-lowest-energy peak, click on <. When finished viewing, click **Cancel** or press <**Esc**>.

5.5.5. Interactive in viewed area...

This selection starts an interactive analysis session by analyzing the spectrum section shown in the active window (note the difference between this command and **Entire Spectrum in Memory...**, Section 5.5.2). The working library selected with **Library/Select File...** is used. The analysis parameters have been set in the **Analyze/Settings/Sample Type...** dialogs. When the analysis is complete, the graphical results and peak area table are displayed as illustrated in Fig. 147.

Figure 148 shows the interactive Analysis Sidebar. The buttons move the marker up and down through the results lists, library, and spectrum simultaneously.

- The buttons in the **Library Peak** section pertain to the results from the analysis; the other buttons pertain to the spectrum. The peak-found buttons move to the next higher or lower peak in the analysis results list. This includes non-zero-area library and unknown peaks above the cutoff. See **Peak** button below.

- The **within Nuclide** buttons move up and down the library list for the selected nuclide, in the order the energies are stored in the library. Since the library energies are not usually stored in increasing energy order, this will jump the marker around in the spectrum. This is useful in

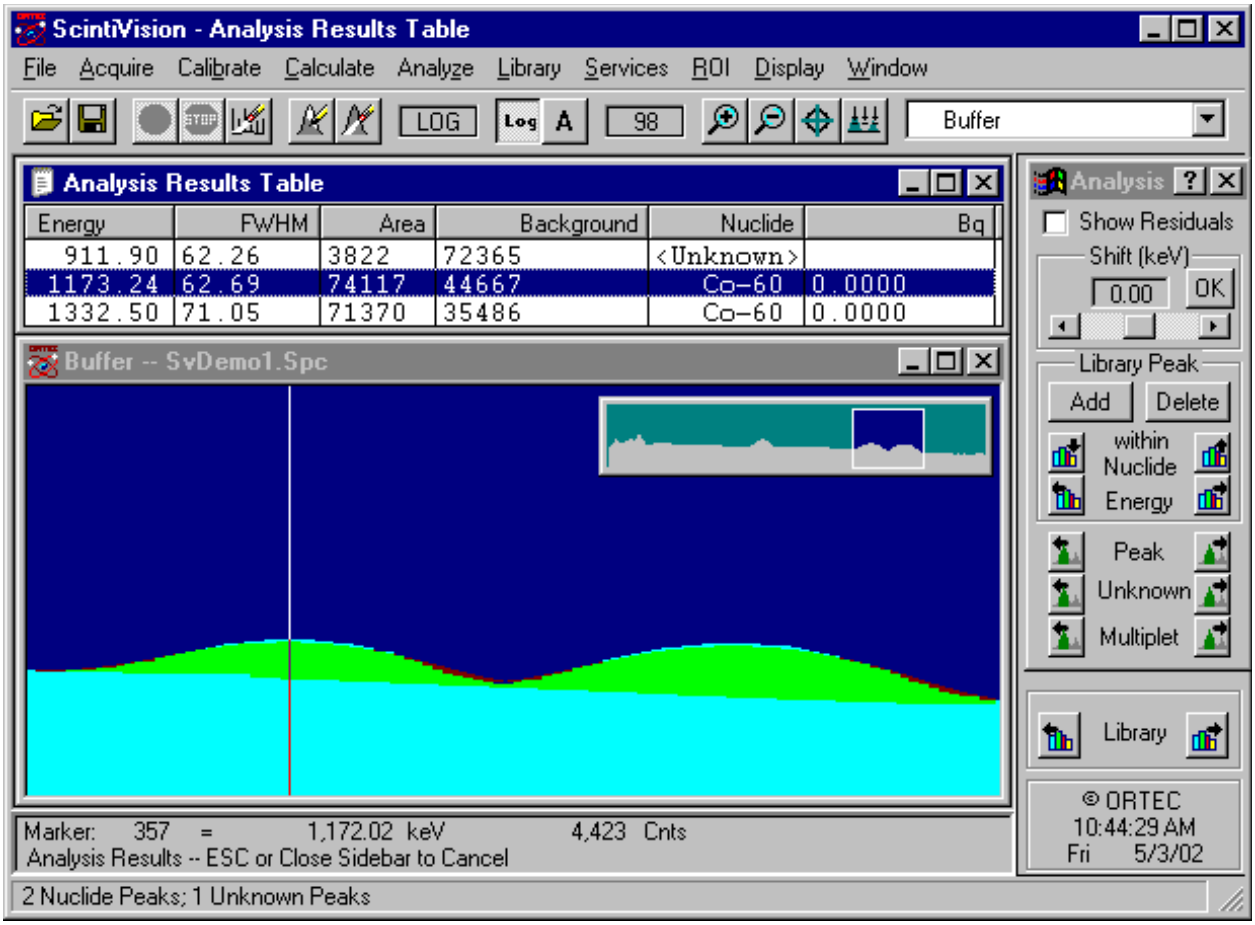


Fig. 147. Results Interactive in Viewed Area.

deciding if a nuclide is present or not, by looking for all the lines associated with the nuclide. Only non-zero-area peaks are displayed.

- The **Energy** buttons move the marker up and down through the library peak list in energy order. Only non-zero-area peaks are shown. Since the library used for the analysis might not be the same as the working library, this could be a different set of peaks than found with the **Library** buttons on the Status Sidebar.

- The **Peak** buttons move the marker up and down through all the peaks in the spectrum. This includes non-zero-area library peaks and unknown peaks above the cut-off.

- The **Unknown** buttons move the marker up and down through the unknown peaks that satisfy the sensitivity cutoff, in energy order, skipping over any library peaks.

Fig. 148. Analysis Display Sidebar.

- The **Multiplet** buttons move up and down through the multiplet or deconvoluted regions in the spectrum. The next time the multiplet up button is clicked, the marker goes to the first (lowest-energy) peak of the next-higher multiplet. The next down button goes to the last (highest-energy) peak of the next-lower multiplet. To look at individual peaks in the multiplet, use the **Peak**, **Energy**, or **Unknown** buttons.

Use the Analysis Sidebar's control menu (the same type of menu as shown in Fig. 145) to show/hide the Analysis Results Table, and the results window's control menu to print the table.

To add a peak to the analysis library, position the marker at the desired location and click on **Add**. This adds a temporary nuclide to the library (assigned the name "Analyze" in the results table) with a peak at this energy. A new analysis starts immediately and the new results are displayed. More peaks can be added as needed.

To delete a peak, click on the peak energy in the Analysis Results List. The marker jumps to this channel in the spectrum. Click on **Delete** to delete the peak. A new analysis starts immediately and the new results are displayed.

The energy calibration for all the peaks in the spectrum can be shifted with the **Shift (keV)** field and slide bar. Select the amount of shift and click on **OK**. ScintiVision will perform the new analysis and display the results.

The residuals are the differences between the calculated spectrum (based on peak shape, peak area, and background) and the actual raw data. These can be displayed in the spectrum window by marking the **Show Residuals** check box. The scaling factor for the residual display is the same as for the data display. In log mode, the scale of the residuals display is somewhat exaggerated and the residuals might appear more significant than they actually are.

5.6. Library

The **Library** menu commands (Fig. 149) allow you to select, display, create, edit, or print the library files used in the **Analyze** and **Calibrate** sections, using either the ScintiVision library editor discussed here or the NuclideNavigator III library editor. Library files are organized by nuclide, then by the nuclide's peaks.

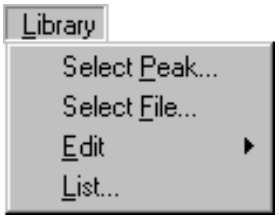


Fig. 149. Peak List Dialog Box.

NOTE NuclideNavigator (`.mdb`-format) libraries can be used *only as master libraries*, not as analysis libraries.

The nuclide library is used with reference to the peak-search or report functions for quantitative identification of and activity calculations for spectral components according to calibrated peak

energy. The nuclide library data include the nuclide name, half-life, and half-life uncertainty. The nuclide names can be any combination of eight characters, but must be consistent throughout all files. The library peak data include the energies and yield or gammas/ disintegration for each energy. The default file extension is **.LIB**.

At startup, ScintiVision automatically attempts to load the library last loaded (the first time you run ScintiVision, the library **DEFAULT.LIB** is used). Thereafter, this *working library* can be replaced at any time with **Library/Select File...**. The library stays resident in memory after it has been loaded.

In the analysis report, the nuclides are listed in the order they are in the library. Libraries by the analysis program are limited to 200 peaks. Master or reference libraries (e.g., **MASTER.LIB** from A53-BI), from which the working libraries are built, can be of any size.

NOTE Some old libraries might need to be rebuilt by copying the complete library to a new library with the **Library/Edit** feature (Section 5.6.3). Do this if you see the "**Can't read library**" error.

5.6.1. Select Peak...

This opens a window containing a list of the library peaks in energy order (Fig. 150). This list shows the nuclide name, energy, gammas/100 disintegrations, and half life. Clicking on any field moves the marker line to that energy in the spectrum.

The Library List can be sorted by nuclide, energy, percent, or half life by clicking on the desired column header.

5.6.2. Select File...

This opens the **Load Library File** dialog. If a library has already been selected, it is shown in the **File name:** field. If **File name:** contains the default entry, ***.LIB**, no library is currently selected. Select the desired disk and filename and click on **Open**. This library becomes the working library.

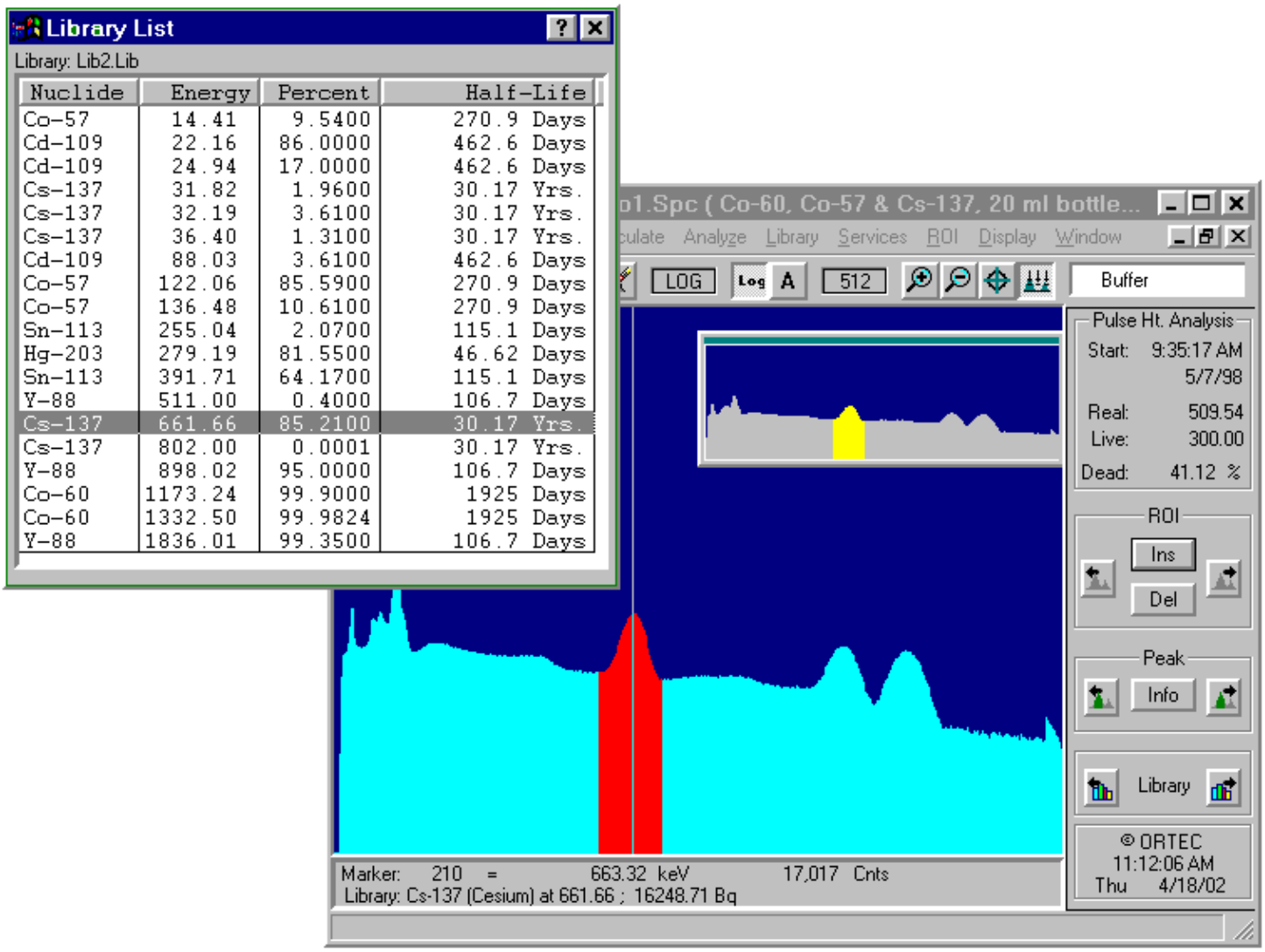


Fig. 150. Library Peak List (note that clicking on a nuclide in the list moves the marker line to the corresponding peak).

5.6.3. Edit...

This submenu contains two commands that allow you to create a new library file or change the contents of an existing library file. It allows you to select the **ScintiVision Editor...** or **Nuclide Navigator...** (if NuclideNavigator III is installed). The ScintiVision library editor is discussed here; the Nuclide-Navigator editor is described in the NuclideNavigator III user manual.

Figure 151 shows the ScintiVision library Editing dialog.

The control menu is shown in Fig. 152 (click on the Title Bar icon to open it); it contains several of the commands necessary to create and edit the `.LIB` files.

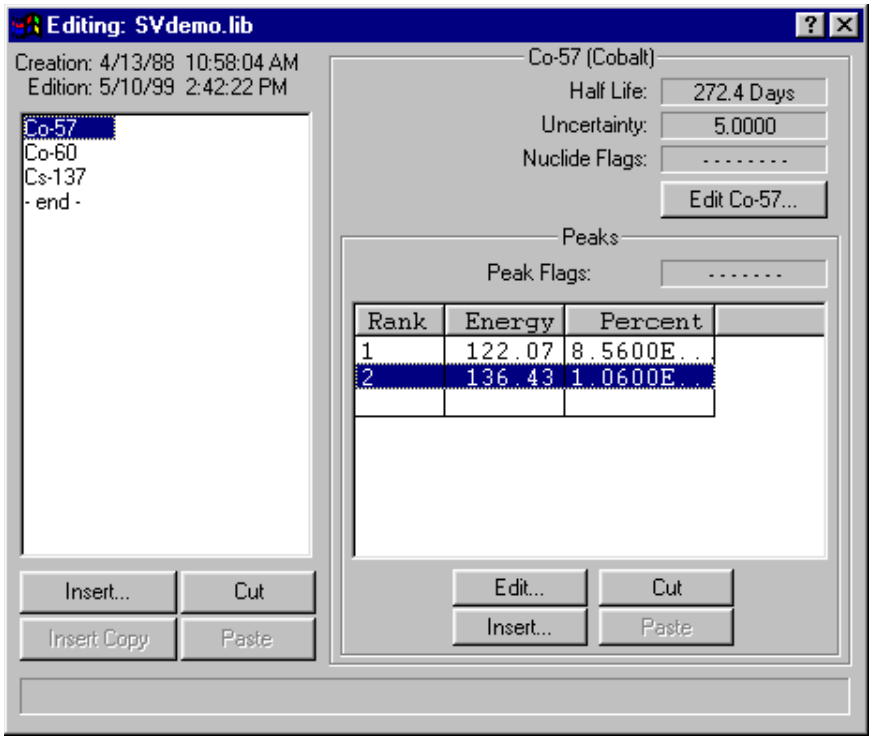


Fig. 151. Editing Library Dialog.

5.6.3.1. Copying Nuclides From Library to Library

To copy nuclides from one library to another library — for example, to make a working library from a master library — click on the **Edit** window's control menu and select **Show Master Library**. This will open a file selection dialog. Choose the desired disk and file and click on **Open**. Both libraries will be displayed side by side, as illustrated in Fig. 153.

Fig. 152. Library Edit Dialog Control Menu.

To copy a nuclide from the master library to the working library: Go to the master library list and click once on the nuclide of interest. This will activate the gray **Insert Copy** button at the bottom of the Editing dialog's nuclide list, and change its label to **Insert** plus the name of the nuclide. Now, in the Editing dialog, locate the nuclide immediately *below* the desired insertion position, click on it once, then click on **Insert [nuclide name]**. This will insert the nuclide and display its peak list on the right.

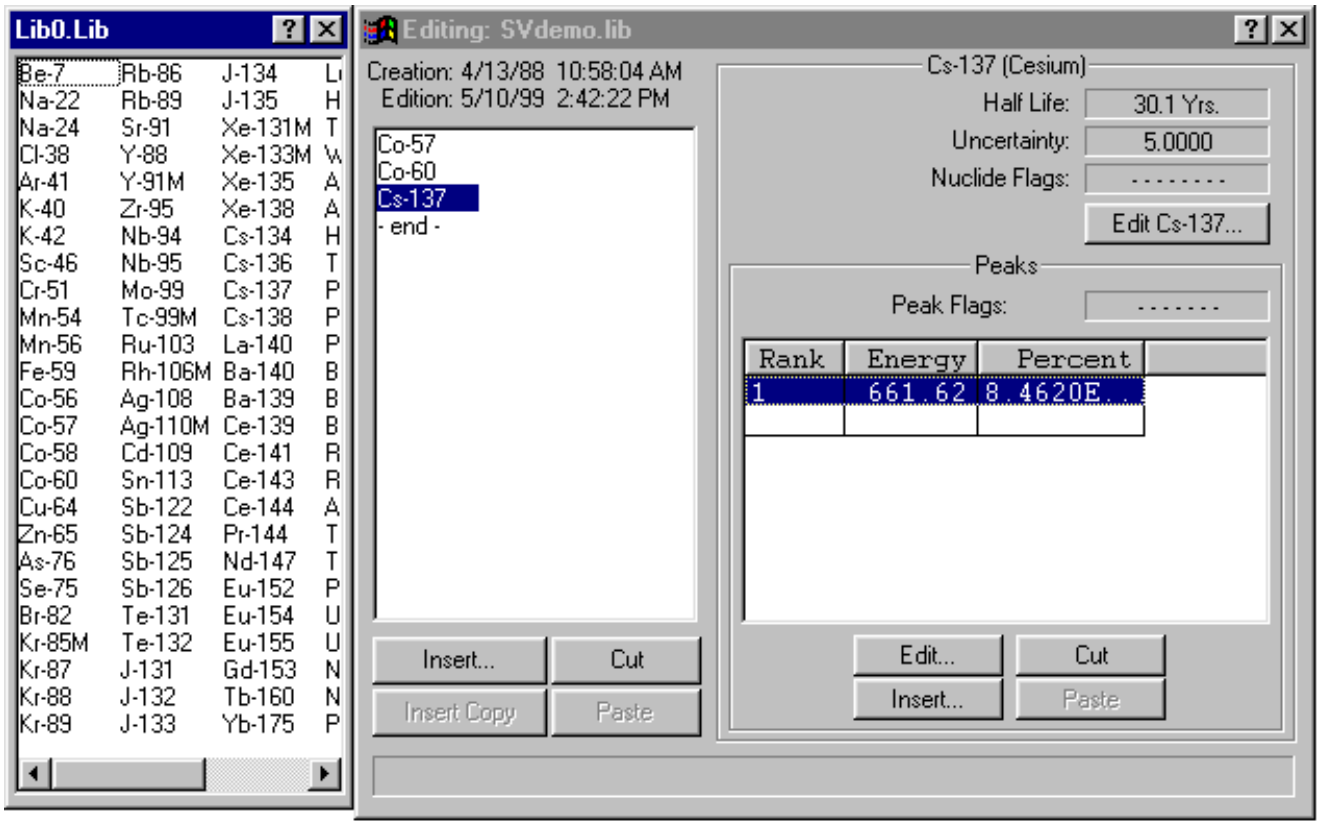


Fig. 153. The Master Library (left) and Library Editing Dialog (right).

Double-clicking on a nuclide in the master library will add it to the working library, inserting it immediately above the currently highlighted nuclide in the list.

5.6.3.2. Creating a New Library Manually

Open the control menu and click on **New**. This will clear the Editing dialog so nuclides can be entered manually. Click on the **Insert...** button to open the Insert Library Nuclide dialog, shown in Fig. 154. Enter the **Nuclide Name** and **Half Life** and click on **OK**.

Now, at the bottom of the (right-hand) peak list, click on **Insert...** to open the Edit Library Peak dialog (Fig. 158). Enter the energy of the gamma ray and the yield of the peak.

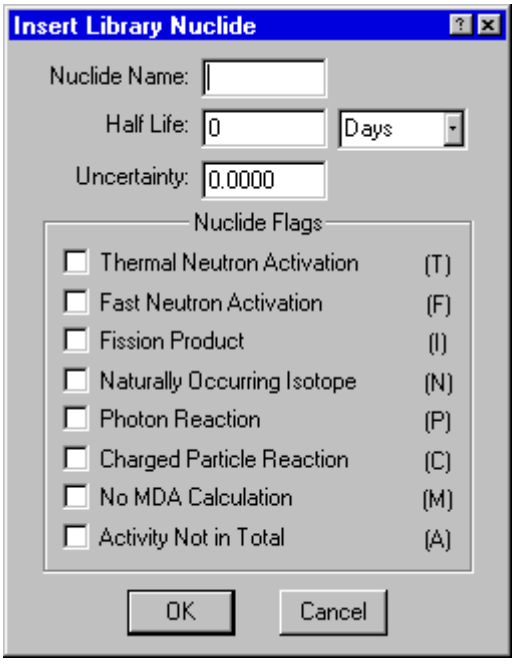


Fig. 154. Insert a Nuclide into a Library.

5.6.3.3. Editing Library List Nuclides

To edit the information about a nuclide in the working library:

Click on the nuclide to highlight it. The **Edit...** button (in the upper right of Fig. 151) will change to **Edit** plus the name of the nuclide, as shown in Figure 155.

Fig. 155. Ready to Edit this Nuclide.

Click on **Edit [nuclide]...**. This will open the Edit Library Nuclide dialog (Fig. 156). The **Nuclide Name**, **Half Life**, **Uncertainty**, and **Nuclide Flags** will already be listed.

The **Uncertainty** is a single number that represents the uncertainty (2 sigma or 95% confidence level) in the values entered for this nuclide. It is added in quadrature to form the total uncertainty on the final report. The **Uncertainty** value should be taken from the nuclear data sheet for this nuclide. The default is zero, but 2% is a realistic number.

The first six **Nuclide Flags** are used to show how the nuclide was produced. For example, **Thermal Neutron Activation (T)** indicates that this nuclide is produced when the parent nuclide absorbs a slow neutron. This can be helpful in organizing reports by nuclide category. More than one flag can be checked. Libraries produced with Nuclide Navigator II or later versions will already have these flags set. For other libraries, it will be necessary to consult a reference for the proper settings.

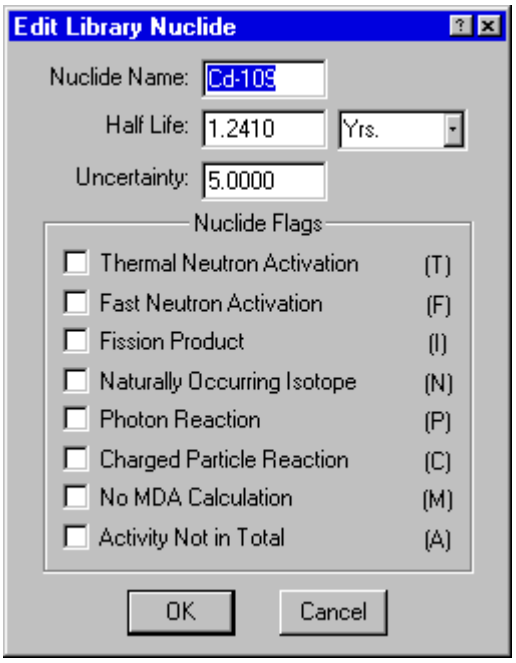


Fig. 156. Edit or Manually Add Nuclide Name.

The **No MDA Calculation** flag indicates that the nuclide will not be reported unless present in the spectrum. If this is not checked, the MDA value will be printed if the nuclide is not present in the spectrum.

The **Activity Not in Total** flag indicates that the activity for this nuclide will not be included in the total activity for this sample.

These flags are listed on the report and saved in the `.UFO` file.

Manually Adding Nuclides

To manually add a nuclide to the library list, locate the nuclide immediately *below* the desired insertion position, and click once to highlight it. Next, click on the manual **Insert...** button to open the Edit Library Nuclide dialog. The dialog will be blank. Fill in the name and half life as well as any other inputs and click on **OK**.

Deleting Nuclides from the Library

To remove a nuclide from the library, click on the nuclide, then on **Cut**. This will remove the nuclide from the list. In addition, it will activate the gray **Paste** button at the bottom of the nuclide list, and change its label to include the name of the cut nuclide. This is illustrated for ^{152}Eu in Fig. 157.

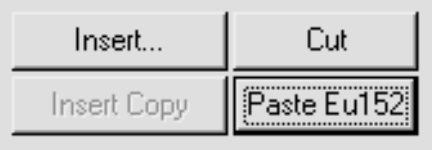


Fig. 157. Cut Nuclide is Ready to Paste.

Rearranging the Library List

The order of the nuclides in the library is the order in which they are listed on the report. Nuclides can be rearranged in the **.LIB** file list by cutting and pasting them into a different location. To move a nuclide to a new position in the list, highlight the nuclide to be moved; **Cut** it from the list; locate the nuclide immediately *below* the desired new position and click once on that nuclide to highlight it; then click on the **Paste** button (which will be labeled with the name of the **Cut** nuclide). The **Cut** nuclide will be inserted in the space above the highlighted nuclide.

Several nuclides can be cut at one time from the list, then pasted back into the list into a different order. Cut nuclides remain queued up for pasting, last one first, according to the nuclide name on the **Paste** button.

To move a nuclide to the end of the library list, **Cut** the nuclide from the list, highlight the **--end--** entry, and click on the **Paste** button**.**

Editing Nuclide Peaks

When a nuclide is selected in the working **.LIB** file, the right half of the Editing dialog shows the peak list. Note the column headers, **Rank**, **Energy**, and **Percent**. To sort the peak list by a particular parameter in the list, click on the appropriate header.

To edit a peak, either double-click on the peak in the right-hand list, or click once on it, then click on the **Edit** button. This will open the Edit Library Peak dialog (Fig. 158). The **Energy (keV)**, **Gammas per 100 Disintegrations**, **Photon Flags**, and **Peak Flags** will already be listed.

The **Photon Flags** are used to show the origin of the peak. Only one can be selected at a time. **Gamma Ray (G)** and **X-Ray (X)** mean the peak energy is due to a

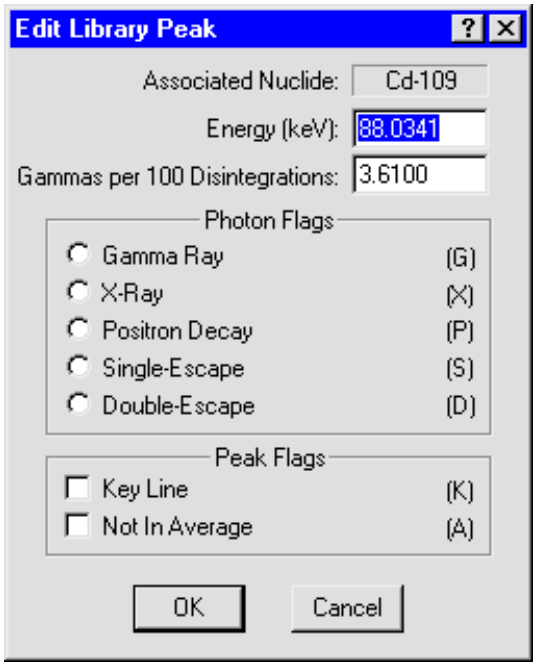


Fig. 158. Edit or Manually Add Library Peak Values.

nuclear or atomic transition, respectively. **Positron Decay (P)** is used for the 511-keV peak. **Single-Escape (S)** peaks are peaks for which a single 511-keV photon has escaped the detector. This can only occur for full-energy peaks above 1.022 MeV. **Double-Escape (D)** peaks are peaks for which two 511-keV photons have escaped the detector. Both single- and double-escape peaks are broader than gamma-ray peaks. Neither can be used for activity calculations because the intensity of the peak is not related directly to the intensity of the full-energy peak. Nonetheless, these can be included in the library to account for the peak in the spectrum.

The **Not In Average (A)** flag in the **Peak Flags** section of the dialog should be set for these peaks. All the peaks marked as **Key Line (K)** must be present before the nuclide will be listed as present on the report. If no lines are marked as key lines, the nuclide will be listed as present if the first line is in the spectrum.[14]

Some old libraries might have these flags set in an unwanted manner. These libraries should be checked before use.

Adding Nuclide Peaks

To add a peak: Click on the peak *just below* the desired insertion point in the peak list, then click on **Insert...**. This will open the Edit Library Peak dialog; all the fields will be blank. Enter the necessary information for the peak and click on **OK**.

Rearranging the Peak List

The entries in the peak list can be rearranged with the **Cut** and **Paste** buttons. Several peaks can be cut at one time from the list, then pasted back into the list into a different order. Cut peaks remain queued up for pasting, last one first. Each relocated nuclide will retain its energy and counts/sec values, but will be assigned a **Rank** number according to its new position. Click on the peak *just below* the desired insertion point in the peak list, then click on **Paste**.

5.6.3.4. Saving or Canceling Changes and Closing

To save this modified `.LIB` file and use it as the working file, click on the control menu, then **Save Library As...**. Either use the current filename (which will overwrite the previous values) or assign a new filename, then click on **Save**. (ScintiVision will assign the default `.LIB` extension.) To exit the edit session, click on the control menu, then **Close**.

To abandon any changes and restore the `.LIB` file to its condition before editing, click on the control menu, then **Close**. A dialog will open asking if the changes should be saved; select **No**.

[14]To duplicate the operation of older versions of ScintiVision, mark either no lines or only the first line as a key line.

5.6.4. List...

The **List...** function prints a list of the library, ordered either by **Nuclide** or **Energy**, to either the printer or a disk file.

5.7. Services

The **Services** menu (Fig. 159) contains several functions and utilities.

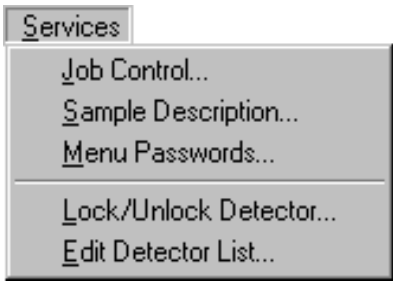


Fig. 159. Services Menu.

5.7.1. JOB Control...

Most of the functions under the various ScintiVision menus can be automated by writing a *JOB*, which consists of one or more commands written in ASCII text (see Chapter 10 for an in-depth discussion). JOBs allow you to easily perform repetitive tasks and/or define initial conditions at Detector startup. These files are given a filename extension of `.JOB`. To start a JOB or edit a `.JOB` file, select **Services/Job Control...** to display the dialog shown in Fig. 160.

To create a new `.JOB` file, use Windows Notepad or another ASCII editor; or open an existing `.JOB` file, edit it, and save it under a new name.

Torun a JOB, select a `.JOB` filename and click on **Open**. The contents of the selected file can be displayed at the bottom of the dialog by using the mouse to mark the **Show Contents** checkbox. Note that displaying the file contents will slow down the accessing of files, especially when browsing through a long list.

Once a JOB is started, most menu functions will be disabled (grayed) to prevent interference with the running JOB. The `.JOB` file name will displayed in the window title.

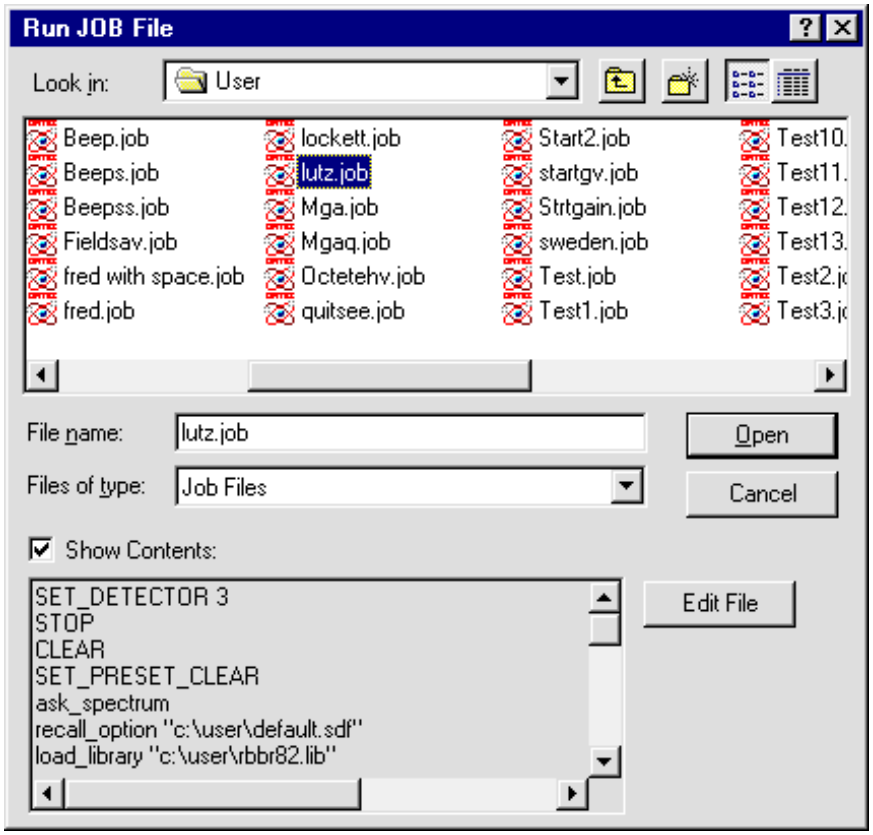


Fig. 160. Run or Edit Job File.

If you try to start another JOB while a JOB is already running, the dialog shown in Fig. 161 will be displayed, showing the name of the current JOB. In this case, the only options available are to terminate execution of the running JOB (click on **Terminate Job**) or allow the JOB to continue (click on **Close** or press **<Esc>**).

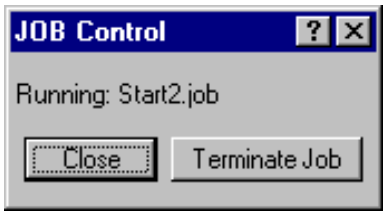


Fig. 161. Terminate Job?

To edit a `.JOB` file from this dialog (whether or not **Show Contents** is activated), select a file from the list and click on the **Edit File** button. This will open the Windows Notepad text editor with the `.JOB` file loaded.

NOTE When editing is complete, save the file in Notepad (select **Save** or **Save As** under Notepad's **File** menu) or any changes made will be lost. When Notepad is closed (**File/Exit**), the newly edited file will be shown in the **Show Contents** list box.

If a JOB terminates prematurely because of some error condition, a message box briefly explaining the cause of the error will be displayed. More details on the error can be found by cross-referencing with the error message directory in Appendix C.

5.7.2. Sample Description...

This function opens the dialog shown in Fig. 162 for examining, editing, or entering the Sample Description of the displayed spectrum. This description can be up to 128 characters in length, and automatically accompanies the spectrum when it is subsequently copied or saved to a file. The description also appears in the title bar at the top of the window while the spectrum is displayed. For files in the `.CHN` format, only the first 64 characters are saved in the spectrum file.

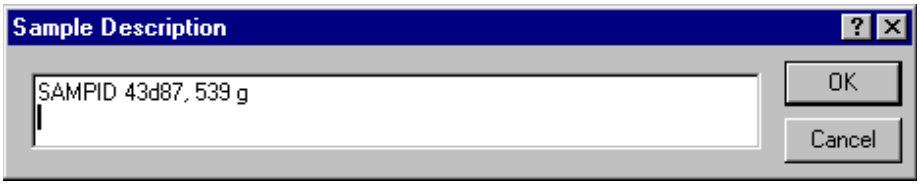


Fig. 162. Enter or Edit Sample Description.

5.7.3. Menu Passwords...

This feature of ScintiVision (Fig. 163) allows you to protect each of the items on all of the menu bar pull-down menus by a password. When a menu item is password-protected, that function cannot be used unless the password is entered. Each menu item can have a different password or the passwords can all be the same.

NOTE ***There is no master password, and passwords cannot be determined from the system***. If the password is lost, contact ORTEC Customer Service for assistance.

Passwords are case-sensitive, that is, upper-case and lowercase letters are ***not*** treated the same. This password protection is valid for all instances of ScintiVision running on this PC. To prevent the use of passwords, password-protect the **Set Password** menu item itself.

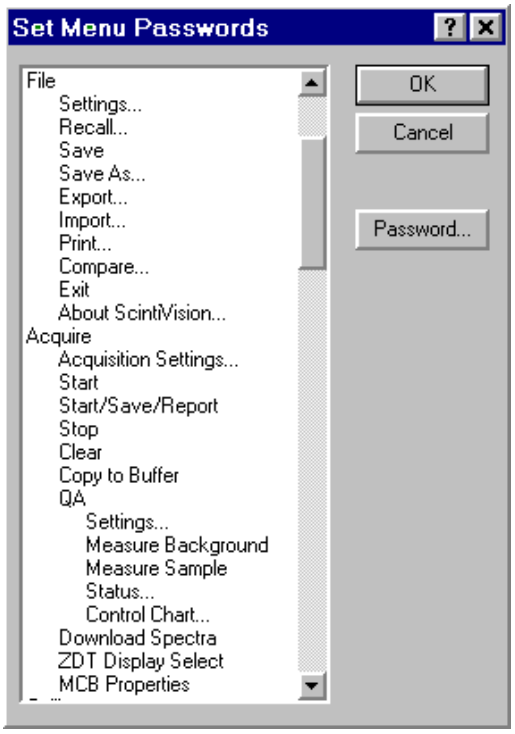


Fig. 163. Menu Passwords.

If a menu item already has a password, there will be an asterisk (*****) to the left its item name. To set, change, or clear the password, click on the menu item name to highlight it, then click on **Password...** to open the next dialog.

If there is no password for this item, the **Password for** dialog shown in Fig. 164 will appear. Enter the **Password**. As the password characters are typed in, they will not be displayed on the screen; instead, they will be echoed with asterisks (*), one for each character. Repeat the password in the **Verification** field. The two entries must agree. Click on **OK**. To leave this dialog without setting or changing a password, click on **Cancel**.

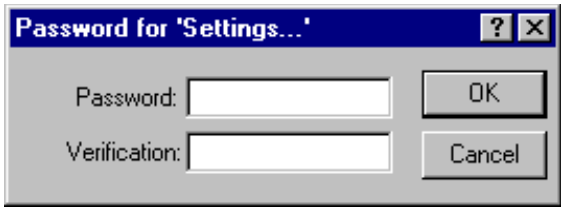


Fig. 164. Password Dialog.

If there is a password for the menu item, a dialog will appear for verifying the old password (Fig. 165). ***You cannot change a password without knowing the old password.*** Enter the old password and click on **OK**.

If the password just entered is not correct, the error message shown in Fig. 166 will appear. If you do not know the old password, click on **Cancel** to exit without changing the password.

Fig. 165. Verify Old Password.

If the password just entered is correct, the **Enter New Password** dialog (Fig. 164) will open for entry of the new password.

Enter a new password, as described above. To remove the password, leave the box in Fig. 164 ***blank (not spaces)*** and click on **OK.**

When finished editing all of the desired passwords, click **OK** on the **Set Passwords** dialog to keep the changes. Clicking on **Cancel** will restore all password states to their previous condition.

Fig. 166. Wrong Password!

5.7.4. Lock/Unlock Detectors...

This facility enables you to protect a Detector from destructive access (e.g., **Start**, **Stop**, **Clear**) by any program on the PC or network. While any program can *view* the data and read the contents on any Detector in the system — locked or unlocked — the contents of a locked Detector cannot be changed without knowing the password.

NOTE ***There is no master password***. If the password is lost, contact ORTEC Customer Service for assistance in unlocking the detector.

If the Detector is currently unlocked, selecting **Lock/Unlock** will show the dialog displayed in Fig. 167. Enter the **Owner** name. Then enter a password in the **Password** field, and re-enter it in the **Verify** field (the two entries must agree). Click on **OK**. The password is not case-sensitive (that is, upper-case and lowercase letters are treated the same).

Fig. 167. Entering Name/Password to Lock a Detector.

If the Detector is currently locked, selecting **Lock/Unlock** will display the dialog in Fig. 168. Enter the correct password to unlock the Detector.

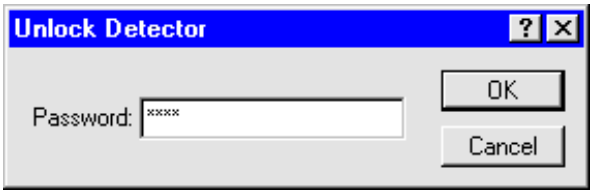


Fig. 168. Unlocking a Detector.

Each time destructive access to a Detector is attempted while it is locked, the **Locked Detector** dialog (see Fig. 169) will ask for the password.

In addition, the owner of the Detector will be displayed on the Supplemental Information Line (see Fig. 170).

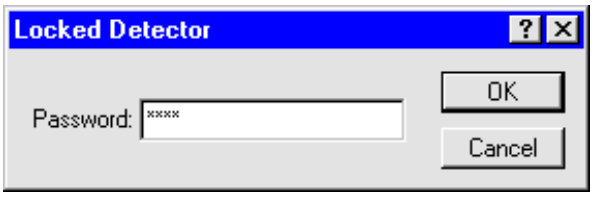


Fig. 169. Password for Accessing Locked Detector.

If the incorrect password is entered in either the **Unlock** or **Locked Detector** dialog, the dialog will reappear, waiting for the correct password. If you do not know the password, click on **Cancel** to abort the access attempt.

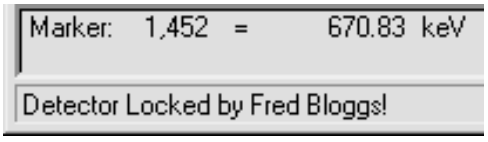


Fig. 170. Name of Person Who Locked Detector.

5.7.5. Edit Detector List...

This allows you to select those Detectors on the system that are to be available in ScintiVision on this PC. Other applications (e.g., GammaVision, MAESTRO) on the same PC can have their own lists. In this way, the different Detectors on the network can be segregated by function or type.

Figure 171 shows the **Detector List Editor** dialog. On the left is the **Master Detector List** of all Detectors on the system. This is created by the MCB Configuration program (see Chapter 2). The default descriptions are derived from the hardware and can be changed by running the configuration program.

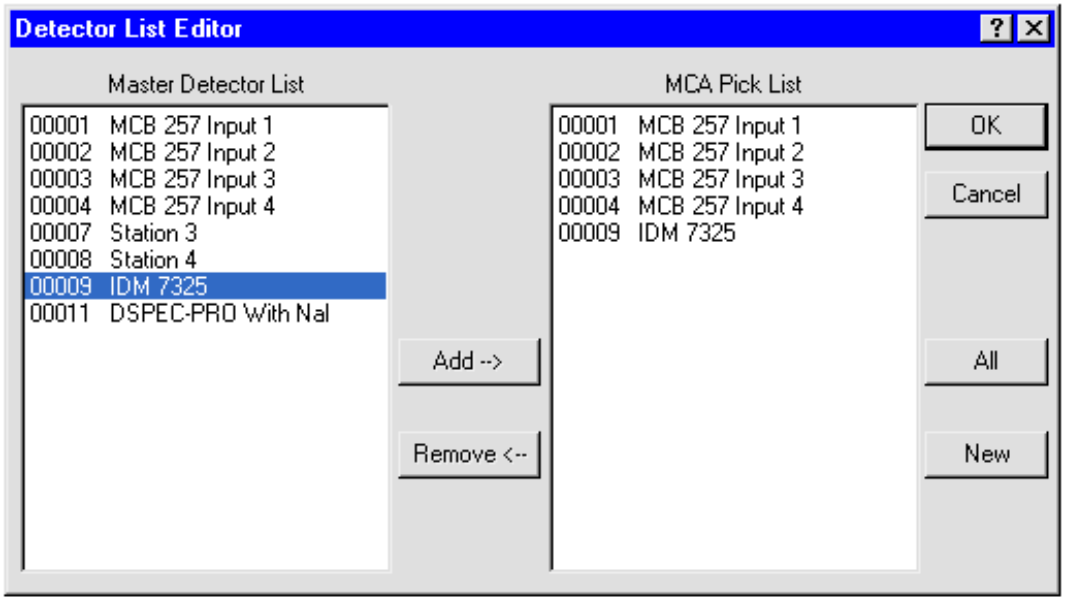


Fig. 171. Detector List Editor Dialog.

On a single-PC system, the ScintiVision installation program initially sets the available Detector list identical to the master list. On a networked system, the system configuration program sets the Detector list identical to the master list. The **Master Detector List**, including the Detector descriptions, are the same for all ORTEC programs (e.g., ScintiVision, MAESTRO, ScintiVision) running on all PCs connected to the workgroup.

To add a Detector to the ScintiVision **Pick List** for this PC, click on the name in the Master list, then click on **Add**. To add all the Detectors on the **Master Detector List**, click on **All**.

To remove a Detector from this local pick list, click on the name in the **Pick List** and click on **Remove**. To remove all the Detectors, click on **New**.

When Detector selection is complete, click on **OK**. These selections will be saved to disk and used by ScintiVision until changed on this screen or until the entire network is reconfigured.

5.8. ROI

An ROI — *region of interest* — is a way to denote channels or groups of channels in the spectrum as having special meaning. An ROI can be used to mark peak areas for the printout or to mark a peak to stop acquisition when that peak reaches a preset value. Channels marked as ROI channels are displayed in a different color than the unmarked channels.

The **ROI** menu is shown in Fig. 172. Its functions are available for both the buffer and Detector(s). See Section 4.3.3 for ROI operations performed with the mouse.

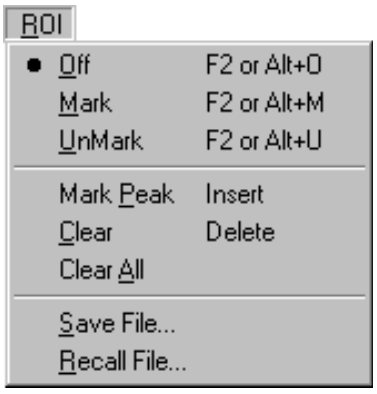


Fig. 172. ROI Menu.

5.8.1. Off

This sets the ROI status to Off. In this state, the ROI bit for the channels will not change as the cursor moves. This function is duplicated by **<Alt + O>** and by **<F2>** (which toggles between **Off**, **Mark**, and **UnMark**).

The usual ROI status is Off so the marker can be moved on the display without changing any of the ROI bits.

5.8.2. Mark

This sets the ROI status to the Mark or set condition. In this state, the cursor channels are marked with the ROI bit as the cursor is moved with <→> or <←> into the channel. Moving the marker with the mouse does not change the ROI in this mode. This function is duplicated **<Alt + M>** and by **<F2>** (which toggles between **Off**, **Mark**, and **UnMark**).

ROIs can also be marked with the rubber rectangle and right-mouse-button menu (see Section 4.3.3), and as described in Section 5.8.4.

5.8.3. UnMark

This sets the ROI status to the unmark or reset condition. In this state, the channels are unmarked with the ROI bit as the cursor is moved with <→> or <←> into the channel. Moving the marker with the mouse does not alter the ROI in this mode. This function is duplicated by **<Alt + U>** and by **<F2>** (which toggles between **Off**, **Mark**, and **UnMark**).

5.8.4. Mark Peak

This function marks an ROI in the spectrum, at the marker position, in one of two ways.

1. If the spectrum is calibrated, the region is centered on the marker with a width of three times the calibrated FWHM. There does not need to be a peak at the marker position.

2. If the spectrum is not calibrated, the region is centered on the peak located within two channels of the marker and as wide as the peak. If the peak search fails, or if the peak is not well-formed, no ROI is marked. There is no limit on the size of a peak or ROI; therefore, in some uncalibrated spectra, large ROIs could be marked.

ROIs can also be marked this way with the **ROI Ins** button on the Status Sidebar, the **Mark ROI** button on the Toolbar, **Keypad<Ins>**, and **<Insert>**.

See also **Mark ROI** on the right-mouse-button menu, Section 5.10.8.

5.8.5. Clear

This clears the ROI bits of all ROI channels contiguous to the channel containing the marker. This is duplicated by the **ROI Del** button on the Status Sidebar, **Keypad<Del>**, the **<Delete>** key, and the **Clear ROI** Toolbar button.

See also **Clear ROI** on the right-mouse-button menu, Section 5.10.9.

5.8.6. Clear All

This resets all the ROI bits in the displayed spectrum (i.e., removes all ROI markings from the spectrum). However, it does not affect the ROI status of **Mark**/**Unmark**/**Off**.

5.8.7. Save File...

This allows you to save to disk a table of the channel numbers, for the current spectrum, that have the ROI set. The contents of the spectrum are not changed.

Selecting **Save File...** displays the dialog in Fig. 173. (Refer to Section 4.5 for tips on using this dialog.) Enter the **File name**. The `.ROI` file extension is recommended, and is used by default. An invalid or null filename will abort the **Save** operation.

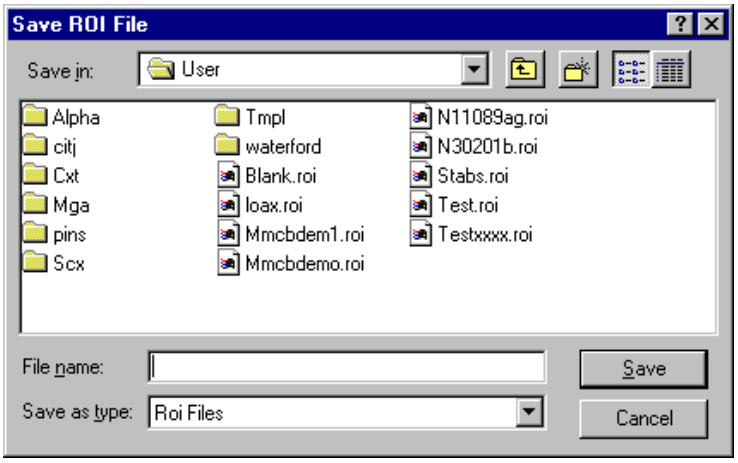


Fig. 173. Save ROI File Dialog.

If the file already exists, the system will display a warning message asking whether you want to overwrite the data in the existing file or cancel the save. Click on **OK** to overwrite the file.

5.8.8. Recall File...

Recall File... sets the ROIs in the buffer or active Detector to the table in the disk file created by **ROI/Save File...** (Section 5.8.7), from the table stored in an **.SPC** file, from the analysis limits in a **.UFO** file, or from the energies in a library. This command opens the dialog shown in Fig. 174, prompting you to select a filename (refer to Section 4.5 for tips on using this dialog). When a file is selected, the ROIs in the buffer or active Detector are set to conform to the table in the file. The previous ROIs are cleared. The data contents of the buffer or Detector are not altered by this operation, only the ROI bits in the buffer or Detector.

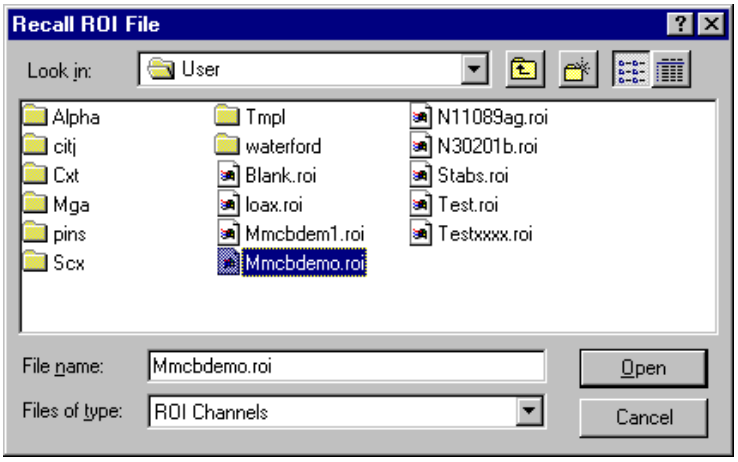


Fig. 174. ROI File Recall Dialog.

In **.ROI**, spectrum, and **.UFO** files, the ROIs are saved by channel number. Therefore, if the spectrum peaks have shifted in position, the ROIs in the file will not correspond exactly to the spectrum data. For library files, the ROIs are generated using the library energies, and the energy and FWHM calibrations.

5.9. Display

Two of the most important functions of the ScintiVision program are to display the spectrum data and to provide an easy and straightforward way to manipulate the data. This is accomplished using the **Display** menu functions, shown in Fig. 175, and their associated accelerators. The **Display** functions are available in both the Detector and buffer modes.

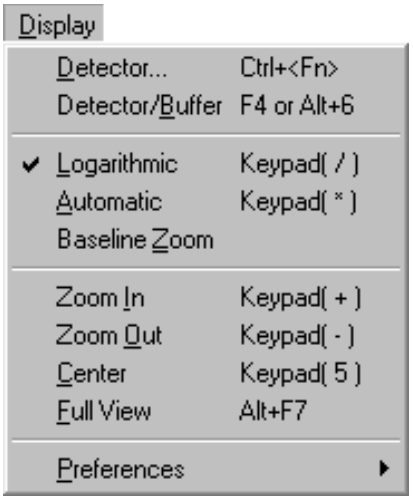


Fig. 175. Display Menu.

5.9.1. Detector...

Selecting this function opens the **Pick Detector** list shown in Fig. 176. Click on a Detector on this list to display its memory in the Full and Expanded Spectrum Views. The **Pick Detector** list shows the available Detectors, listed by Detector number, and a brief description.

This is duplicated by the droplist on the Toolbar (see page 36). In addition, the first 12 Detectors on the list can be selected by pressing **<Ctrl + F1>** for the first Detector in the pick list, **<Ctrl + F2>** for the second Detector, and so on, through **<Ctrl + F12>** (see Section 9.4.7).

The current pick list is selected from the Master Detector List using **Services**/**Edit Detector List...**, as discussed in Section 5.7.5. Whenever the system is reconfigured, Fig. 177 will be displayed so you can remake the list (**Yes**), leave it as is (**No**), or cancel the Detector selection process (**Cancel**).

Clicking on **Yes** will open the **Detector List Editor** dialog (Fig. 178), the same dialog accessed through **Services**/**Edit Detector List...**. Follow the instructions in Section 5.7.5.

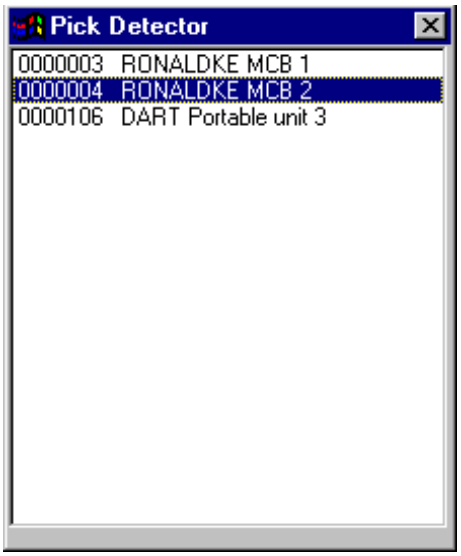


Fig. 176. Detector Selection List.

Fig. 177. Detector List Warning.

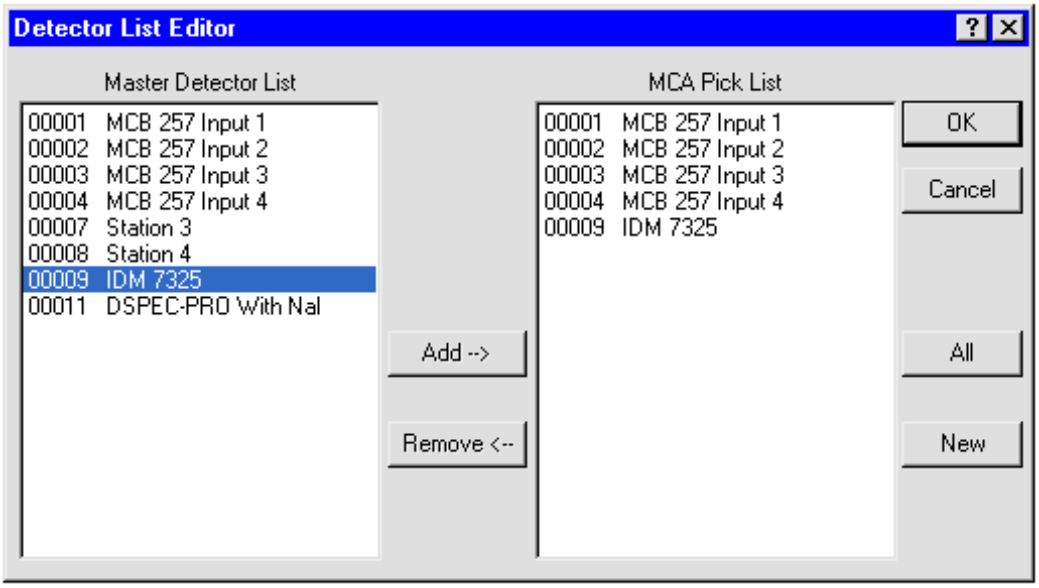


Fig. 178. Detector List Selection.

5.9.2. Detector/Buffer

This command switches the source of the spectrum and Status Sidebar displays between the selected Detector and the buffer. The Full and Expanded Spectrum Views display the data in histogram form. The source of the displayed spectrum (Detector or buffer) is shown on the Toolbar and Title Bar. The corresponding descriptors (live time, real time, dead time, and start time) as well as the presets are shown in the Status Sidebar. The marker remains in the same channel when switching between Detector and buffer modes unless the Detector and buffer do not have the same memory size. The horizontal and vertical scales remain the same in both views. This function is duplicated by the accelerators **<F4>** and **<Alt + 6>**. The Toolbar's Detector list can also be used.

5.9.3. Zoom In

Zoom In adjusts the horizontal and vertical scales in the Expanded Spectrum View to view a smaller portion of the spectrum. The vertical scale is divided by two and the horizontal scale is reduced by about 6% of the full horizontal scale. The current horizontal and vertical full-scale values are shown on the Toolbar (see Fig. 179).

This command is duplicated by **Keypad<+>**, the Toolbar's **Zoom In** button, and **Zoom In** on the right-mouse-button menu.

Fig. 179. Vertical and Horizontal Full-Scale Setting on the Toolbar.

5.9.4. Zoom Out

Zoom Out adjusts the horizontal and vertical scales in the Expanded Spectrum View to view a larger portion of the spectrum. The vertical scale is doubled and the horizontal scale is increased by about 6% of the full horizontal scale.

This command is duplicated by **Keypad<−>**, the Toolbar's **Zoom Out** button, and **Zoom Out** on the right-mouse-button menu.

5.9.5. Logarithmic

Logarithmic toggles the vertical scale of the Expanded Spectrum View between the logarithmic and linear modes. This function is duplicated by **Keypad</>** and the **Log/Linear Display** button on the Toolbar.

5.9.6. Automatic

Automatic switches the Expanded Spectrum View to a linear scale that is automatically adjusted until the largest peak shown is at its maximum height without overflowing the display. It also toggles the vertical scale of the spectrum display between the automatic and manual modes. If

the logarithmic scale was enabled, the display is switched to linear. This function is duplicated by **Keypad<*>** and the **Vertical Auto Scale** Toolbar button.

5.9.7. Baseline Zoom

Baseline Zero switches to autoscale mode, then sets and keeps the baseline of the expanded display at zero counts. Autoscale is then switched off. This function is duplicated by the **Baseline Zoom** Toolbar button.

5.9.8. Center

This function forces the marker to the center of the screen by shifting the spectrum without moving the marker from its current channel. This function is only required when moving the marker with the mouse; the keyboard functions for moving the marker automatically shift the spectrum to center the marker when the marker travels past the end of the current expanded display. **Center** is duplicated by **Keypad<5>** and the **Center** button on the Toolbar.

5.9.9. Full View

Full View adjusts the horizontal and vertical scaling to display the entire spectrum in the Expanded Spectrum View. This command is duplicated by **<Alt + F7>**.

5.9.10. Preferences...

This displays the options available for selecting the screen colors and spectrum display options. The submenu is shown in Fig. 180.

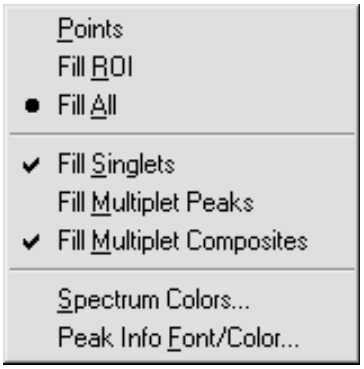


Fig. 180. Display Preferences Submenu.

5.9.10.1. Points/Fill ROI/Fill All

Use these functions to select the histogram display mode for both spectrum windows.

In **Points** mode, the data are displayed as points or pixels on the screen, in the colors chosen for **Foreground** and **ROI** under **Display**/**Preferences**/**Spectrum Colors...** (see Section 5.9.10.3).

In **Fill ROI** mode, the unmarked regions of the spectrum are displayed as points, while the ROIs are filled from the baseline to the data point with the **ROI** spectrum color.

In **Fill All** mode, all the data points are filled from the baseline to the data point with the **Foreground** and **ROI** spectrum colors.

Figure 181 shows a comparison of the three display modes. Note that the point/pixel size in the **Point**- and **Fill ROI**-mode illustrations has been exaggerated to make them easier to see.

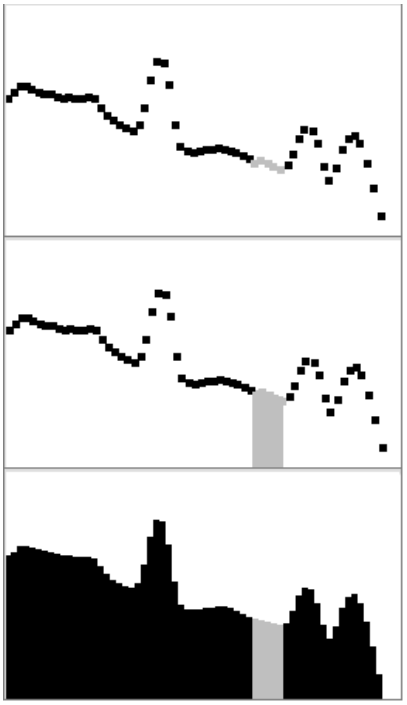


Fig. 181. Comparison of the Points, Fill ROI, and Fill All Display Modes.

Users will find that the display update speed is dramatically affected by the display mode; the more areas filled on the screen, the slower the screen will update. Therefore, the preferred modes for normal operation will most likely be **Points** and **Fill ROI** because of their faster update. **Fill All** might be reserved for screen captures because of its greater clarity of presentation.

5.9.10.2. Fill Singlets/Fill Multiplet Peaks/Fill Multiplet Composites

The peaks detected during analysis can be displayed as contrasting, solid lines superimposed on the spectrum, or can be filled to background height with a contrasting color.

Choose whether to fill singlets, multiplets, and/or multiplet composites by clicking on the menu item(s) to mark them with a checkmark. Click again to remove a checkmark. The fill color for these peaks can be selected on the **Spectrum Colors...** dialog, discussed in the next section.

5.9.10.3. Spectrum Colors...

Use this dialog (see Fig. 182) to select colors for various features in the two spectrum windows. Each scroll bar controls the color of a different feature. The vertical colored stripes behind the scroll bars show the available colors.

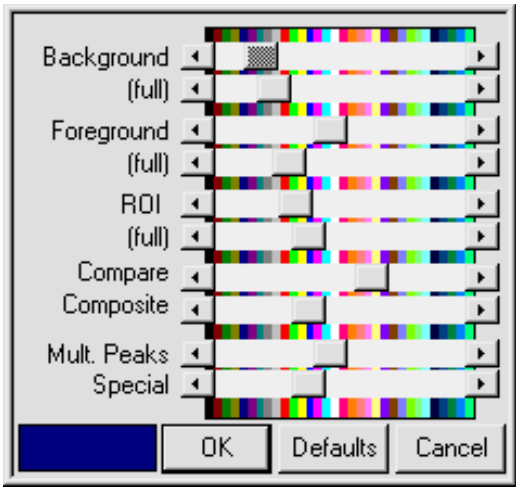


Fig. 182. Display Color Selections.

The **Background** scroll bar controls the background color of the spectrum window, **Foreground** determines the color of the spectrum points or fill, **ROI** governs the color of the ROI points or fill.

The points/fill of a compared spectrum (**File**/**Compare...**) use the **Compare** color, unless they overlap with the original spectrum, in which case the **Composite** color is used.

To change a color, click and hold the left mouse button on the scroll bar button and drag it slowly across the different colors. When the desired color is displayed in the box beside the **OK** button, release the mouse button. The spectrum window will immediately change color.

To cancel a color change, return the slider button to its starting color, or close the **Spectrum Colors...** palette by clicking on **Cancel** or pressing **<Esc>**.

To reset the color values to the original ScintiVision colors, click on **Defaults**.

To accept the color changes, click on **OK**. These color changes will be recalled the next time ScintiVision is started.

NOTE The **Spectrum Colors...** affect only the spectrum windows. The colors of the remaining features on the screen must be changed using the Windows Control Panel (which will also, of course, affect the appearance of all other Windows applications on this PC).

5.9.10.4. Peak Info Font/Color

This function opens the **Font** dialog (see Fig. 183). It allows you to select the font type, size, and color used to display **Peak Info** data in the text box in the spectrum windows (see Section 5.4.2, Fig. 117).

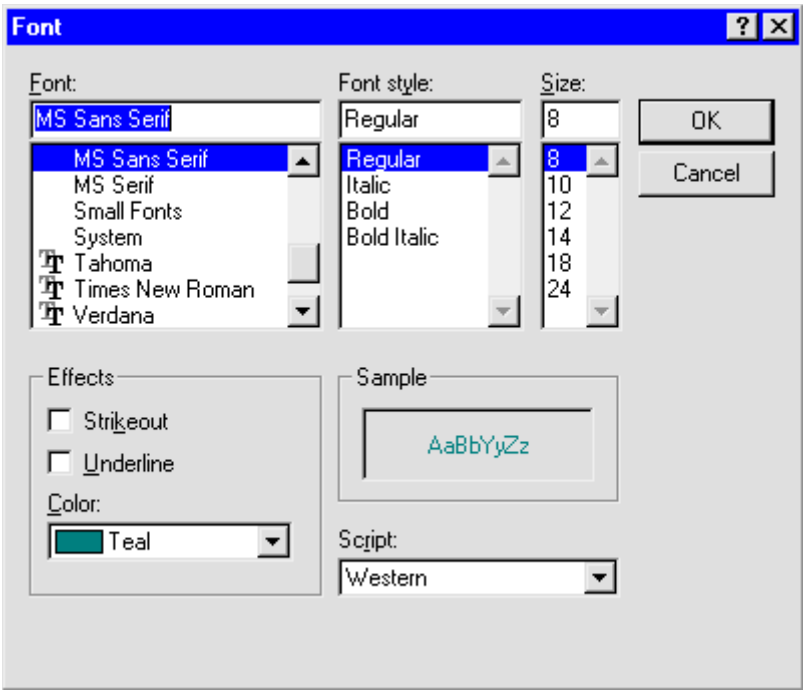


Fig. 183. Peak Info Font Selection.

5.10. Right-Mouse-Button Menu

Figure 184 shows the right-mouse-button menu. To open it, position the mouse pointer in the spectrum display, click the right mouse button, then use the left mouse button to select from its list of commands.

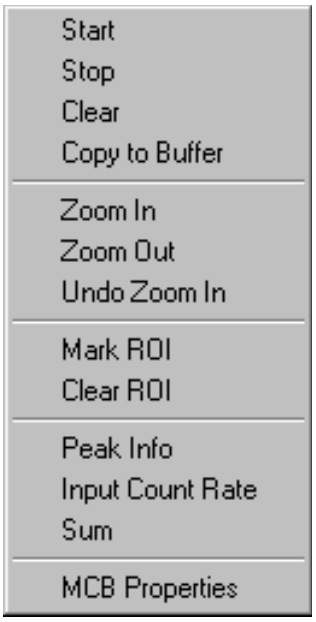


Fig. 184. Right-Mouse-Button Menu.

5.10.1. Start

This initiates data collection in the selected Detector. Any warnings arising from problems detected at the hardware level will appear in a message box or on the Supplemental Information Line at the bottom of the display. The Detector can also be started with the **<Alt + 1>** accelerator, the **Start Acquisition** button on the Toolbar, or the **Start** command on the **Acquire** menu. If the Detector is already started or if ScintiVision is in buffer mode, this entry is grayed.

5.10.2. Stop

Stop terminates data collection in the selected Detector. The display must be in Detector mode. If the Detector is not active, the entry is grayed. The Detector can also be stopped with the accelerator **<Alt+ 2>**, the **Stop Acquisition** button on the Toolbar, and the **Stop** command on the **Acquire** menu.

5.10.3. Clear

Clear erases the Detector spectral data and the descriptors (e.g., real time, live time, start time) for the selected Detector. The presets are not altered. (This function might not operate on some types of Detectors when they are collecting data.) The data can also be cleared with **<Alt+ 3>**, the **Clear Spectrum** button on the Toolbar, or the **Clear** command on the **Acquire** menu.

5.10.4. Copy to Buffer

The **Copy to Buffer** function transfers the data and descriptors (e.g., live time, real time), from the selected Detector to the buffer. This function can also be performed with **<Alt + 5>** or the **Copy to Buffer** command on the **Acquire** menu.

5.10.5. Zoom In

Zoom In adjusts the horizontal and vertical scales in the Expanded Spectrum View to view a smaller portion of the spectrum. If the rubber rectangle is not being used, the vertical scale is divided by two and the horizontal scale is reduced by about 6% of the full horizontal scale. If the rubber rectangle is being used, the display shows only the contents of the rectangle. The

minimum display is 6% of the horizontal full scale. The current horizontal and vertical full-scale values are shown on the Toolbar.

This command (not using the rubber rectangle) is duplicated by **Keypad**<+>, the Toolbar's **Zoom In** button, and **Zoom In** on the **Display** menu.

5.10.6. Zoom Out

Zoom Out adjusts the horizontal and vertical scales in the Expanded Spectrum View to view a larger portion of the spectrum. The vertical scale is doubled and the horizontal scale is increased by about 6% of the full horizontal scale.

This command is duplicated by **Keypad**<−>, the Toolbar's **Zoom Out** button, and **Zoom Out** on the **Display** menu.

5.10.7. Undo Zoom In

This will undo or reverse the last **Zoom In** operation done with the rubber rectangle. It restores the display to the horizontal and vertical expansion before the **Zoom In**. It is not the same as **Zoom Out**.

5.10.8. Mark ROI

This function marks an ROI in the spectrum for the total width of the rubber rectangle. All channels are marked. See also Sections 4.3.3 and 5.8.4.

5.10.9. Clear ROI

This clears the ROI bits of all channels in the rubber rectangle or all ROI channels contiguous to the channel containing the marker. See also Section 5.8.5.

5.10.10. Peak Info

If the marker is in an ROI, this displays one of the following:

1. If the spectrum is not calibrated, the channel centroid, FWHM, and FW(1/x)M, in channels, are displayed.

2. If calibrated, the channel centroid, FWHM, and FW(1/x)M, in channels and energy, the gross and net area, gross and net peak count rates, activity of isotope (if efficiency calibrated), and the library "best match" are displayed.

If the marker is not in an ROI, the peak limits used are the same as the limits for the **ROI Ins**ert button on the Status Sidebar, and the report is generated according to items 1 and 2 above.

The x-factor is determined in **Calculate/Settings...**. The peak information is displayed in a pop-up box at the top of the peak (Fig. 117). This is duplicated by double-clicking the mouse in the ROI or with **Calculate/Peak Info**. To close the box, left-click on it or press **<Esc>**.

If the Detector is acquiring data, the values displayed are continuously updated with new values based on the new data.

See Section 5.4.2 for peak calculation details.

5.10.11. Input Count Rate

The input count rate feature is supported by a number of our newer digital spectrometers. For these units, the input count rate can be shown in the upper left corner of the spectrum window. This is input count rate and not the number of processed pulses.

The buffer shows the input count rate when the spectrum was (1) transferred to the buffer from the MCB or (2) saved to disk. If the MCB is stopped, the value displayed is the current input count rate value and not the value when the MCB was stopped.

5.10.12. Sum

The **Sum** function performs its calculation in one of three ways, depending on the position of the marker:

1. If the marker is not in an ROI and a box is not defined, the sum of the data channels of the Detector is shown on the display. The complete channel width (e.g., 1 to 16384) is summed.

2. If the marker is not in an ROI and a box is defined, the sum of the data channels in the box is shown on the display.

3. If the marker is in an ROI, the sum of the data channels in the ROI is shown on the display. This is the same as the gross counts in the **Peak Info** display, but can be used on wider ROIs.

5.10.13. MCB Properties...

This command access the MCB setup dialogs discussed in Section 5.2.10.

6. ANALYSIS METHODS

ScintiVision incorporates the analysis engine **GSA.DLL**. ("GSA" is an acronym for Gamma Spectrum Analysis.) **GSA.DLL** provides the kernel of functions necessary for analysis of gamma-ray spectra acquired with NaI detectors. This chapter describes the calculations performed and the algorithms employed by this analysis engine.

NaI detector spectra are characterized by significantly poorer resolution (caused by fewer ADC channels combined with broader peaks) and, therefore, more interference (overlapping peak areas) along with poorer signal-to-noise ratios than corresponding HPGe spectra. Therefore, NaI spectra inherently require significantly different algorithms for proper peak extraction and activity analysis. The **GSA.DLL** analysis engine was developed with such limitations of NaI spectra in mind. Its main features include:

- Peak-search algorithms appropriate to NaI spectra.
- Activity-analysis algorithms appropriate to NaI spectra for multiplet decomposition and for identifying and quantifying the activities of nuclides present.

6.1. Peak Search

Each peak is located in a spectrum using a variable-Gaussian cross-correlation method (discussed below), whereupon a working model of the background is obtained based on the endpoints of the peak envelope detected. Estimates for the background-subtracted net area and centroid are computed based on this model and the counts in the spectrum in that vicinity. The only inputs required are

- Spectrum data to be searched.
- An estimate of the FWHM of the peaks (this can be a full FWHM calibration or just a single-constant FWHM value approximating the expected width of peaks to be found).

The peak search provides:

- A list of peak centroids.
- Initial estimates of the background and peak area(s), computed as if these peaks were pure Gaussian singlets superimposed on a simple linear background.

Note that these centroids are accurate only for pure singlets; therefore, subsequent peak fitting (see below) is normally recommended for complete peak information in all cases.

6.1.1. Peak Search Algorithm

The spectrum is smoothed, then a filtered spectrum *F* is calculated at channel *i* from the smoothed spectrum *S*:

$$F(i) = S(i) - 0.5 \times \left(S(i + FWHM(i)) - S(i - FWHM(i))\right)$$

where *FWHM(i)* is the calibrated FWHM value at channel *i*.

Around a Gaussian peak, the filtered spectrum has a maximum when the center point of the window coincides with the center point of the peak (i.e., when *i* = center of peak). If the smoothed spectrum contains a peak, then the filtered spectrum will contain a minimum on each side of the peak. These minima are negative. The maxima obtained in this filtering process identify possible peak locations. These "peak candidates" are further processed as discussed below.

6.1.2. Background Method and Initial Peak Estimates

Peak limits are obtained during the peak search at the point where the filtered spectrum drops below zero on either side of the peak. We assume that background is defined by three points above and below these peak limits. An average at each of these endpoints is computed and a straight-line is "drawn" between these endpoints to model the background across the peak region.

An initial estimate of the FWHM of the peak can be obtained from the width of the region of the filtered spectrum that is greater than zero. The peak location is set to the maximum.

Finally, the area is obtained from the background-subtracted data using the formula for a perfect Gaussian:

$$Area = Fit\ Height \times FWHM \times \frac{\sqrt{2\pi}}{2.35} \qquad \textbf{(13)}$$

where:

$Fit\ Height$ = $F(i_1) - F(i_2)$
i_1 = channel where *F* is maximum
i_2 = channel where *F* is minimum

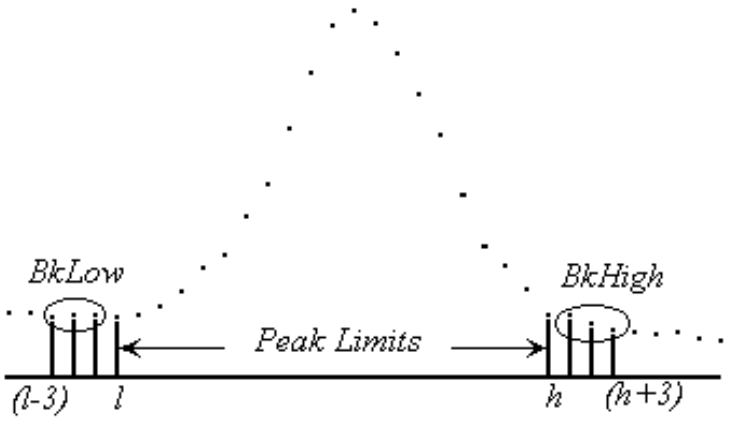


Fig. 185. Peak Limits and Background Points.

6.1.3. Peak Statistics

The uncertainty (1 sigma) in the net area of the peak is computed as follows:

$$Net\ Uncertainty = \sqrt{Background\ Variance + Gross\ Area} \quad \textbf{(14)}$$

where the *Background Variance* was computed as follows:

$$Background\ Variance = \left(\frac{Background^2}{(Channels)(BackLo + BackHi)} \right) \quad \textbf{(15)}$$

where:

Channels	=	number of channels in peak
BkLo	=	background per channel at low end of peak
BkHi	=	background per channel at high end of peak

6.1.4. Critical Level/Peak Rejection Criteria

Peaks can be rejected for use in subsequent analysis steps if they do not meet the minimum criterion expressed by the *Critical Level*:

$$Critical\ Level = 2.33\sqrt{Background\ Variance} \quad \textbf{(16)}$$

The net area of each peak is tested against this value and marked as “PRESENT” only if it exceeds this level. In the case of peaks involved in multiplets, the test will be repeated as necessary after the peaks have been deconvoluted.

6.2. Peak Fitting

After locating the peaks, the FWHM must be more accurately determined, as well as the position and net area for each peak.

The list of peaks found in the peak search is combined with the library list for further fitting. Library peaks not located in the peak search are inserted into the peak list positions and FWHM’s calculated with the calibration coefficients. The first step in peak fitting is to divide the spectrum into regions containing one or more overlapping peaks. Peaks and background in these regions are fitted alternately, the appropriate type of background being determined by the energy and number of peaks in the region. The peak amplitude, width, and position are found by minimizing χ^2.

6.2.1. Background Fit

Two types of backgrounds are used in fitting NaI spectra: polynomial and stepped. At low energies the background is typically represented by a polynomial with up to 4 coefficients calculated by a weighted least-squares fit. At higher energies the background is linear, with steps added at the centroid of each peak in a multiplet. The **Analyze/Settings/Sample Type...** dialogs let you choose an automatic determination of the best type of background fit, or to set the energy at which the background switches from polynomial to linear. In most cases, the automatic setting will give a better result.

At this time, the peak centroid, height, starting point, and ending point are the values from the peak fitting routine.

6.2.1.1. Linear Backgrounds

Singlets

Singlets are fitted with a linear background using the spectrum values at the end points of the peak. The number of values used in the average is set by you in the **Analyze/Settings/Sample Type...** dialog to 1, 3, or 5. To calculate the background on the low energy side of the peak with 5 points, the 5-point average of the channel contents is calculated for the region below the start of the peak. This is the same as smoothing the data with a smoothing width of 5 and coefficients

of 0.2 for all points. The calculation is repeated in the region above the end of the peak, and the background is:

$$Background = B_L + \frac{(B_H - B_L) \times (C_H - C_L)}{C_H - C_L} \quad \textbf{(17)}$$

where:

B_L = low background
B_H = high background
C_H = high channel
C_L = low channel

Multiplets

In high energy regions the background is roughly linear, and the background for peak multiplets is calculated in an analogous manner to singlets. If the slope above the peak region is less than the slope below the region, (that is, if the background under the peaks is declining faster than the background above the peaks), a step is inserted at the centroid of each peak (see Fig. 186).

Fig. 186. Stepped Background.

The total height of the steps is equal to the difference between the background above and below the peak area. The steps are smoothed over the width of the peak, and the height of each step is proportional to the height of the peak.

Polynomial backgrounds

In low-energy regions, the background is best represented by a polynomial. To obtain the best background fit in non-peak regions, the fitted peaks are subtracted from the spectrum before the background fit is performed. If this is not the first time the region has been fitted, a weighted least-squares fit is used, with data below the current background level weighted more heavily than data above the current background. This gives a better estimate of the background in the presence of peaks. Coefficients are calculated for linear, quadratic, and cubic fits, and the polynomial that gives the smallest value of χ^2 is returned.

Sparse peak regions

If the peaks in a multiplet overlap by only a few channels, the background is fitted as a polynomial. It is also appropriate to fit small peaks at low energies with a polynomial background. At high energies, if this is a refit, points with a background above the array value are weighted more heavily than points with background below the array value. In the example shown below, the background is a parabola:

$$B = (169.242 - 1.87175 \times (C - C_{Start})) + (0.002288748 \times (C - C_{Start})^2) \quad \textbf{(18)}$$

where:

B	=	background in channel C
C	=	channel
C_{Start}	=	start channel = 111

The constant values are calculated by the program based on the fit to the spectrum data.

6.2.2. The Peak Fit

Before the peaks are fitted, the background is subtracted from the spectrum. The error in the peak fit can be represented by:

$$\chi^2 = \sum_{i=Min}^{Max} \frac{(F_i p(i) - b(i))^2}{w_i} \quad \textbf{(19)}$$

where F_i is the spectrum data at channel i, $b(i)$ is the fit to the background, $p(i)$ is the fit to the peak, and w_i is the weight. The sum is over the entire fitting region. The peaks are represented by Gaussians, so

$$p(i) = \sum_{j=1}^{N} c_j e^{-(x-x_j)^2/2\sigma_j^2} \quad \textbf{(20)}$$

where N is the number of peaks in the multiplet. The best values of the constant c_j, position x_j, and FWHM ($2.53\sigma_j$) of each peak are those that minimize χ^2. The uncertainties of the constant, position, and FWHM are also calculated.

Starting with the values found in the peak search, the background and peak fit is repeated at most three times. If the region has been fitted to the noise level, the fit is saved. Otherwise, peaks are added or removed at the channel with the largest residual.

6.2.2.1. Adding and Removing Peaks

The channel with the largest residual value is found, and if the residual is positive, and if adding a peak improves the fit, a peak will be added there. If the largest residual is negative, the peak closest to that channel might be removed. Up to ten peaks can be added to, or subtracted from, a fitting region. After the region is fitted, χ^2 is calculated. If the new fit has not changed χ^2 by more than $0.1 \times (\textit{the largest residual} - \textit{convergence limit})^2$, the fit is saved and the program moves to the next fitting region. The convergence limit is a parameter entered on the Options tab of **Analyze/Settings/Sample Type...** (Section 5.5.1.1).

6.2.2.2. Directed Fit Method

Another method of obtaining the peak area for a particular energy is to fit the spectrum region with a background plus peak shape function. This so-called “directed fit” can be applied to peaks and has the ability to produce negative peak areas. The negative peak area will produce a negative activity and this will be reported. Negative activities are required by some reporting agencies for statistical purposes.

The directed fit to the library peak area is done if the following are true:

1. The option is enabled.
2. The spectrum is energy calibrated.
3. The peak area was zero in the regular analysis.

If all these conditions are met, the spectrum region for 2 times the calibration FWHM, centered on the peak energy, is fit as above, but with the area allowed to go negative.

6.3. Library-Based Peak Stripping

In a few cases, all of the gamma-rays emitted by one isotope are very close in energy to gamma-rays emitted by other isotopes in the sample. The peaks from the two gamma rays cannot be separated correctly using conventional analysis, so the activity for one isotope cannot be correctly determined. ScintiVision can perform library-based peak stripping, as an alternative to deconvolution, to obtain peak areas of the components of a multiplet. This alternative method (also referred to as peak-interference correction) uses peak areas from other parts of the spectrum to determine the areas of some of the components and calculates the remaining areas. Library-based peak stripping uses the library specified on the Sample tab under **Analyze/Settings/Sample Type...**.

As the first step, ScintiVision searches the library for isotopes with severely overlapping gamma rays. The criterion for severe overlap is that the peaks are within two channels of one another (regardless of the energy per channel). For peaks this close, the peak areas will be more accurate if they are found indirectly. Any such peaks are automatically marked in the library as being too close together.

For example, the only useful gamma ray emitted by ^{226}Ra is 185.99 keV. The peak overlaps the 185.72-keV peak of ^{235}U. If these two isotopes are both in the library, ^{226}Ra and the 185.72-keV ^{235}U peak are flagged when the library is read. Table 5 shows some other common examples. These energies are from Erdmann and Soyka. Other references might use different energies, but the overlaps will still occur.

Table 5. Gamma Peak Overlap Examples.

Isotope	Energy (keV)	Probability	Isotope with close energy
^{99m}Tc	140.99	89.3	^{99}Mo
^{224}Ra	241.00	3.90	^{92}Sr
^{226}Ra	185.99	3.28	^{235}U
^{241}Am	26.35	2.5	^{237}U
^{241}Am	33.20	0.11	^{144}Ce
^{241}Am	59.54	36.3	^{237}U

The spectrum is then analyzed as described with one exception: *any peaks that are marked as too close are not used in the isotope activity calculations*. Instead, the activity of one isotope is based on other gamma rays from that isotope. That activity is then used to calculate the contribution to the overlapped peak of this isotope. That contribution is subtracted from the total peak area to obtain the peak area due to the other isotope.

In the example above, the activity of ^{235}U is calculated from the area of the peak at the next most probable energy, i.e., 143 keV. Then the area of the 185.72-keV ^{235}U peak is calculated using the yield (branching ratio) of that gamma ray, the efficiency, and the activity. The ^{235}U area is subtracted from the area of the peak at 185 keV to give the area due to ^{226}Ra. From this, the activity of ^{226}Ra in the sample is calculated.

6.4. Peak Identification

After the peaks in a spectrum have been properly located and measured using the searching and fitting procedures discussed above, the next step is to identify these peaks with the emitting nuclides, and ultimately to compute the activities of these nuclides.

6.4.1. Peak Identification

Using (1) the energy-calibrated spectrum, (2) a list of peaks from the peak search and fit, and (3) a nuclide library, each peak can be assigned to a nuclide by finding the best match(es) between the energies of peaks found in the spectrum and the library energies.

6.4.2. Fraction Limit Test

In order to verify the identification of a particular nuclide to a given peak, the number of located peaks is compared to the number of possible peaks. This is expressed as the fraction figure:

$$Fraction = \frac{\sum_{l=1}^{n} BranchingRatio_l}{\sum_{p=1}^{n} BranchingRatio_p} \quad \textbf{(21)}$$

where *BranchingRatio* is the yield for the peak for the given nuclide, *l* is the sum over the located peaks, and *p* is the sum over the possible peaks. This fraction is between 1.00 for all peaks located and 0 for no peaks located. This value is compared to a limit value to determine whether this nuclide's peaks are present in sufficient measure to say this nuclide is present. The *Fraction Limit Test* is passed if the fraction (as percent) is above the value entered on the System tab under **Analyze/Settings/Sample Type...** (Section 5.5.1.1).

6.4.3. Decay Limit Test

Another test for the validity of a nuclide identification is to reject nuclides that have decayed between the collection time for the sample and the spectrum time. If the time elapsed between sample and data collection is too large, this nuclide will have decayed away. This determination is referred to as the *Decay Limit Test*, and the limit is entered on the Options tab under **Analyze/ Settings/Sample Type...** (Section 5.5.1.1).

6.4.4. Nuclide Activity

After all the peaks have been properly identified and decomposed, the nuclide activity is calculated.

The individual *peak activities* are calculated first, starting with the net area of each peak divided by the acquisition live time, to give the counts per second detected. This is then adjusted by the calibrated efficiency supplied to give the disintegrations per second at the source. This is then divided by the yield (branching ratio) for the peak to give the activity in becquerels. The attenuation correction is also applied.

The *nuclide activity* is computed as an average of the individual peak activities, weighted by the yields of these peaks as follows:

$$Nuclide\ Activity = \frac{\sum (Peak\ Activity \times Branching\ Ratio)}{\sum Branching\ Ratio} \quad \textbf{(22)}$$

The *uncertainty* in this value is computed by adding the peak uncertainties in quadrature as follows:

$$Uncertainty = \sqrt{\frac{\sum (PeakUncertainty)^2}{Number\ of\ Peaks}} \quad \textbf{(23)}$$

The nuclide activity can also be *decay corrected*, which is based on the time elapsed between sample collection and data acquisition and the nuclide half-life.

6.4.5. Statistical Detection Limits

These are only used in connection with library peaks not found in the spectrum, to provide a lower limit for activities, based upon the counting statistics of the data detection.[15,16]

Peaks marked as type MDA will be processed differently in that their peak limits are determined as a multiple of the expected FWHM rather than being determined by the peak search as described earlier. Otherwise, the background calculations are the same, only using these artificially determined peak boundaries.

6.4.5.1. MDA (Minimum Detectable Activity)

The first step in calculating the MDA is to calculate the Minimum Peak Area (MPA) that could be undetected. The MPA is given by the following formula:

$$MPA = 2.71 + 3.29\sqrt{2(Bkg\ Variance)} \quad \textbf{(24)}$$

where *Bkg Variance* is calculated in **Eq. (15)** if the peak is located; or is calculated in **Eq. (25)** when the peak is too small for Poisson statistics (not located).

$$Bkg\ Variance = \sum_{i=l}^{h} C_i \quad \textbf{(25)}$$

where:

C_i = the channel contents of channel i
l = the peak lower limit
h = the peak higher limit

The peak high and low limits are (MDA factor/2 × FWHM) above and below the centroid energy, for a total width of (MDA factor × FWHM). The MDA factor is defined on page 122 and entered on the Options tab under **Analyze/Settings/Sample Type...** (Section 5.5.1.1). The FWHM is calculated from the calibration FWHM formula.

---

[15]"The Minimum Detectable Activity Concept," Joseph C. Lochamy, *Measurements for the Safe Use of Radiation*, NBS 75th Anniversary Symposium, March 1976.

[16]*Detection Limits for Radioisotopic Counting Techniques*, page 10, J.K. Hartwell, ARH-2537, June 1972.

The MDA is then given as the following formula:

$$MDA = \frac{MPA}{\varepsilon \times T \times \gamma_d} \quad \textbf{(26)}$$

where:

ε = the efficiency at the peak energy
T = the live time of the acquisition
γ_d = the yield

It should be noted that the MDA value will not always represent the maximum activity of a particular nuclide that might be present in a sample. Rather, it measures the limit of detection for that particular nuclide. Theoretically, if a nuclide activity exceeds the detection limit, the peak will be found by the peak search, and will be matched with a nuclide and/or be reported as an unknown peak, with an actual activity being reported as much greater than the MDA.

The subtraction of the PBC area and the recalculation of the percent error can result in the new net peak area being below the sensitivity cutoff and thus eliminating this peak from being used in the activity calculation. If the first library peak is rejected, the MDA is reported.

6.5. Peak Background Correction

The Peak Background Correction (PBC) is used to correct for the presence of an isotope in the background spectrum that also occurs in the sample. If the isotope is not of interest in the analysis results, there is no need to make this correction. The correction subtracts peak counts in the background spectrum from the peak counts in the sample.

The PBC values in the PBC table are the counts-per-second at each library energy and these values are subtracted from the counts-per-second values of the sample spectrum before the above corrections. The PBC value is added to the background and the new error is calculated by multiplying the percent error by the ratio of the uncorrected area to the corrected area.

This method improves on older PBC methods because the peak count rates are stored in the PBC table for each energy in the spectrum and not the average rate for an isotope. This removes the dependence on the efficiency calibration in the PBC table, yielding more accurate results because the nuclides in the background are not in the same geometry as the sample, meaning that the efficiency calibration is not the one to be used.

7. THE REPORT

A typical ScintiVision report is shown in Figs. 187 through 192. The exact details of the report depend on the options selected, the spectrum, the calibration, and the libraries.

7.1. First Page

The first page of the report (Fig. 187) shows all the bookkeeping data that are stored with the spectrum files along with other messages about the analysis.

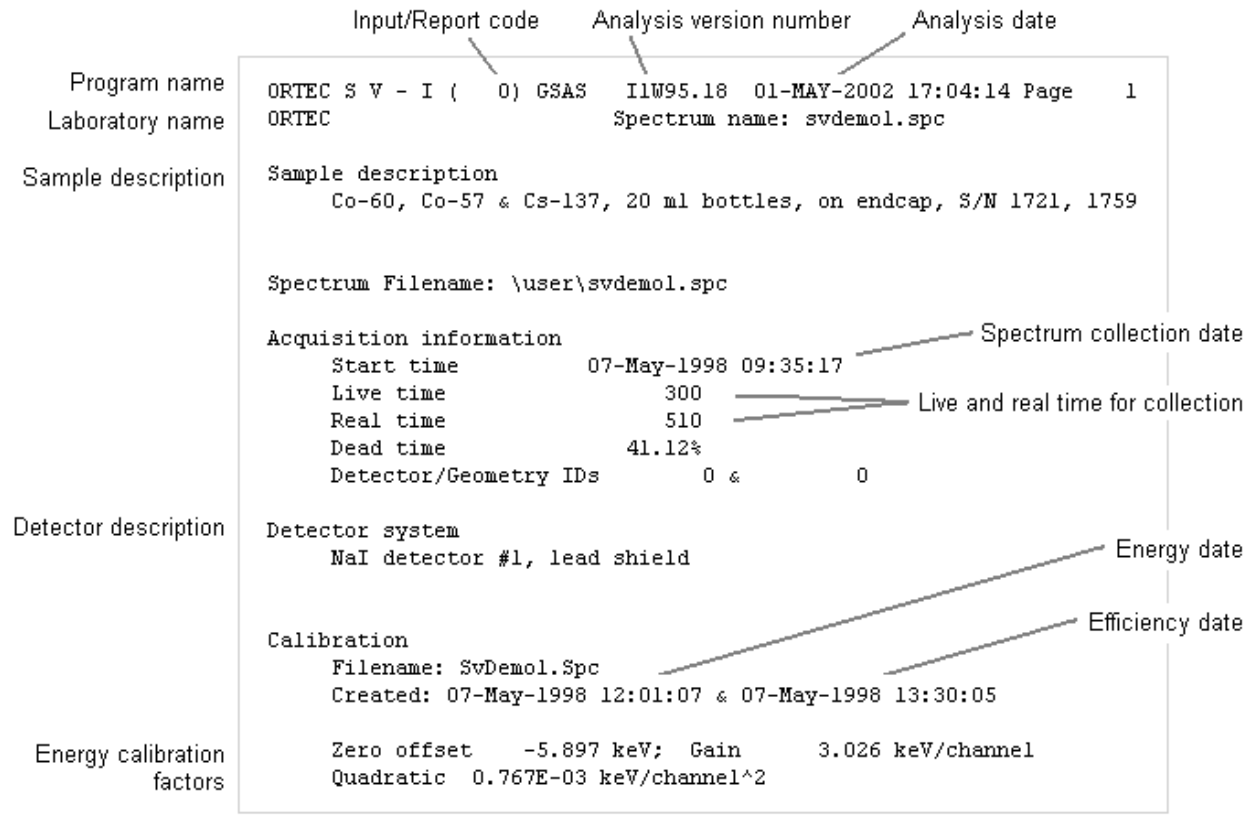


Fig. 187. ScintiVision Analysis Report, Page 1.

PROGRAM NAME

This is the name of the program that produced this report; it does not change.

LABORATORY NAME

This is the name of the laboratory as entered under **Analyze/Settings/Sample Type...**.

INPUT/REPORT CODE

This number represents the operator input requests and the status on the program's ability to fulfill these requests. Normally, this code just confirms that the proper analysis was performed. In the case where the output report does not appear to be the correct form, this code can help locate the difficulty.

ANALYSIS VERSION NUMBER

As updates to the internal algorithms are made, this number is changed. It is only useful when requesting assistance for a particular spectrum. The second line of the header is specified on the System tab under **Analyze/Settings/Sample Type...**. The top two lines are repeated on each page of the report.

ANALYSIS DATE

The date the analysis was performed.

SAMPLE DESCRIPTION

The sample description is from the spectrum file. The **.SPC** file description is 128 characters (two lines) and the **.CHN** file description is 63 characters (one line).

SPECTRUM FILENAME

This is the operator input name for the original name of the **.SPC** file.

SPECTRUM COLLECTION DATE

This is the date the spectrum was collected as recorded in the spectrum file.

SPECTRUM COLLECTION LIVE TIME, REAL TIME

The live time and real time values as stored in the spectrum file.

DETECTOR DESCRIPTION

The detector description are from the spectrum file. The **.SPC** file descriptions are 128 characters each (two lines) and 63 characters each (one line) for the **.CHN** files.

CALIBRATION

The calibration filename and description are from the spectrum file if it is an **.SPC** file. If the file is a **.CHN** file, a message is printed that the calibration is from MAESTRO.

CALIBRATION DATE FOR ENERGY AND EFFICIENCY

This is the date the calibration calculation was performed. It is not the collection date of the calibration spectrum.

ENERGY CALIBRATION FACTORS

The energy factors are the offset and slope from the calibration data in the **.SPC** or **.CHN** file. The quadratic factor is not printed.

The rest of page 1 is shown in Fig. 188.

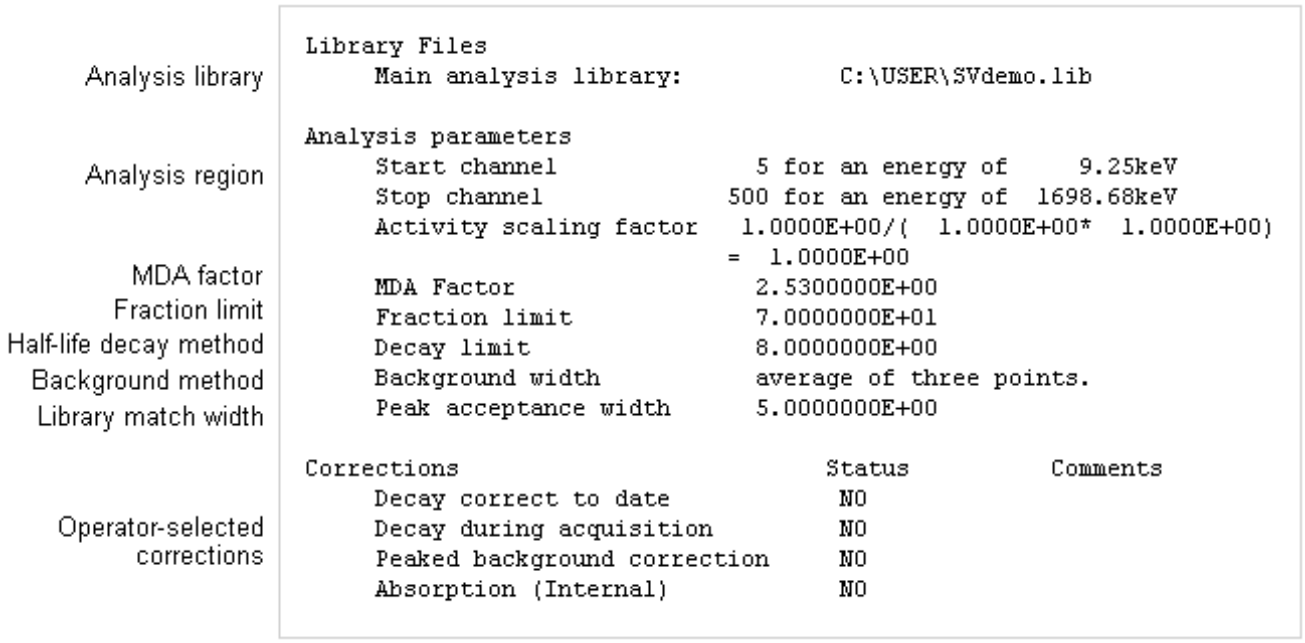


Fig. 188. ScintiVision Report Page 1, continued.

LIBRARY FILENAME

The analysis library filename is printed. If the library was not found, then a “not found” message is printed here.

MDA FACTOR

This is the factor used in the MDA calculation, as set on the System tab under **Analyze/Settings/Sample Type...**.

ANALYSIS REGION

This is the start/stop channels as input by the operator. The analysis region in energy is printed at the end of the report.

NORMALIZATION FACTOR

This is the factor to change the output activities to the requested units from the internal units of becquerels. It is the quotient of the input multiplier and input divisor. A value of 1.0 leaves the activities in becquerels.

FRACTION LIMIT

This is the value used in the analysis to reject isotopes, as set on the System tab under **Analyze/Settings/Sample Type...**.

HALF-LIFE DECAY LIMIT

This is the decay limit for rejecting isotopes, as set on the System tab under **Analyze/ Settings/Sample Type...**. .

BACKGROUND METHOD

The background method selected by the operator is shown here.

LIBRARY MATCH WIDTH

This is the peak acceptance width set by the operator in the **Analysis Settings** dialog.

CORRECTIONS

All of the available corrections are listed along with the on/off status.

DECAY DATE

The decay-corrected activity is corrected to this date. If the decay correction is off, this is blank.

DECAY DURING ACQUISITION

If the decay during acquisition was enabled, then this is on. The correction could be small due to the ratio of the half-life to the real time, so the effect might not be seen in the output activity.

7.2. Unidentified Peak Summary

Figure 189 shows the second page of the report. The first section of this page provides the peak/energy matrix of the unidentified peak summary. You can suppress this report.

PEAK CHANNEL

The first column is the peak channel as determined by the peak finder (see page 197). It is reported to two decimal places, but normal variation can be in the tenths of a channel.

CENTROID ENERGY

The second column shows the peak centroid in energy if the spectrum is calibrated, zero otherwise. This is the first column converted to energy according to the energy coefficients in the calibration data. This, too, is reported to the nearest hundredth of a channel. Peaks are included in the unknown list if they are too far from a library peak, so these extra digits might be of use.

LIST OF PEAK FLAGS

This is a list of the flags that are printed at the far right of this page.

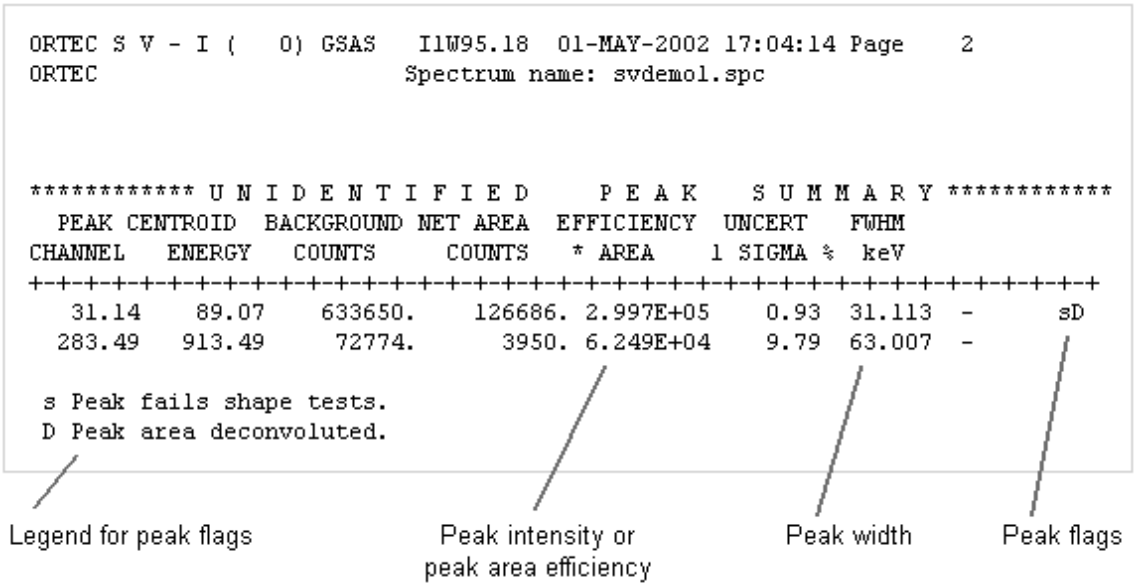

ORTEC S V - I (0) GSAS I1W95.18 01-MAY-2002 17:04:14 Page 2
ORTEC Spectrum name: svdemo1.spc
********** U N I D E N T I F I E D P E A K S U M M A R Y **********
PEAK CENTROID BACKGROUND NET AREA EFFICIENCY UNCERT FWHM
CHANNEL ENERGY COUNTS COUNTS * AREA 1 SIGMA % keV
31.14 89.07 633650. 126686. 2.997E+05 0.93 31.113 - sD
283.49 913.49 72774. 3950. 6.249E+04 9.79 63.007 -
s Peak fails shape tests.
D Peak area deconvoluted.
Legend for peak flags
Peak intensity or peak area efficiency
Peak width
Peak flags

Fig. 189. Unidentified Peak Summary on Page 2.

BACKGROUND COUNTS

The third column shows the background under the peak.

NET AREA COUNTS

The fourth column shows the net area which is the gross area minus the background area. The area is calculated by the summation method for singlets and by the fitting method for multiplets.

INTENSITY CTS/SEC

The next column shows the net area divided by the live time to yield the counts/second for the peak — *or* — the peak area times the efficiency at this energy. To choose which will be printed, edit G30WINDS.INI (Section A.2.2).

UNCERTAINTY

The next column shows the counting uncertainty for this net peak area, as selected on the Report tab under **Analyze/Settings/Sample Type...**. The choice of 1-, 2-, or 3-sigma value is operator selected.

PEAK WIDTH

The next column shows the FWHM of the net peak area. This is in energy if the spectrum is calibrated, otherwise it is in channels.

The next column shows a symbol if the peak is too wide or too narrow as compared to the shape calibration. For acceptable peaks, or if the spectrum is not calibrated, the column is blank.

The last column shows a symbol if the peak is within the deconvolution range of a library peak or peaks. If this occurs, this region of the spectrum should be investigated to see if the line should be added to the library to ensure that the peak areas are correctly calculated. It can also mean that the system is not correctly energy calibrated.

7.3. Identified Peak Summary

The next section (Fig. 190) shows the peak/energy matrix for the library peaks. The library name is printed at the beginning of the list. They are arranged in ascending energy order. The list can be suppressed. It will not be generated if the library is not found or the spectrum is not calibrated.

LIBRARY USED

This shows the name of the library used for the peak list shown below.

NUCLIDE

The first column shows the nuclide name as listed in the library.

PEAK CHANNEL

The second column is the peak channel as determined by the peak finder (see page 197). If the peak centroid cannot be found, then this is set to 0, along with the remaining entries on this line. It is reported to two decimal places, but normal variation can be in the tenths of a channel.

CENTROID ENERGY

The third column shows the peak centroid in energy if the spectrum is calibrated, zero otherwise. This is the first column converted to energy according to the energy coefficients in the calibration data. This, too, is reported to the nearest hundredth of a channel. Peaks are included in the unknown list if they are too far from a library peak, so these extra digits might be of use.

BACKGROUND COUNTS

The fourth column shows the background under the peak. In most cases this is the straight-line background, but can be the stepped background in a deconvoluted region.

NET AREA COUNTS

The fifth column shows the net area which is the gross area minus the background area. The area is calculated by the summation method for singlets and by the fitting method for multiplets.

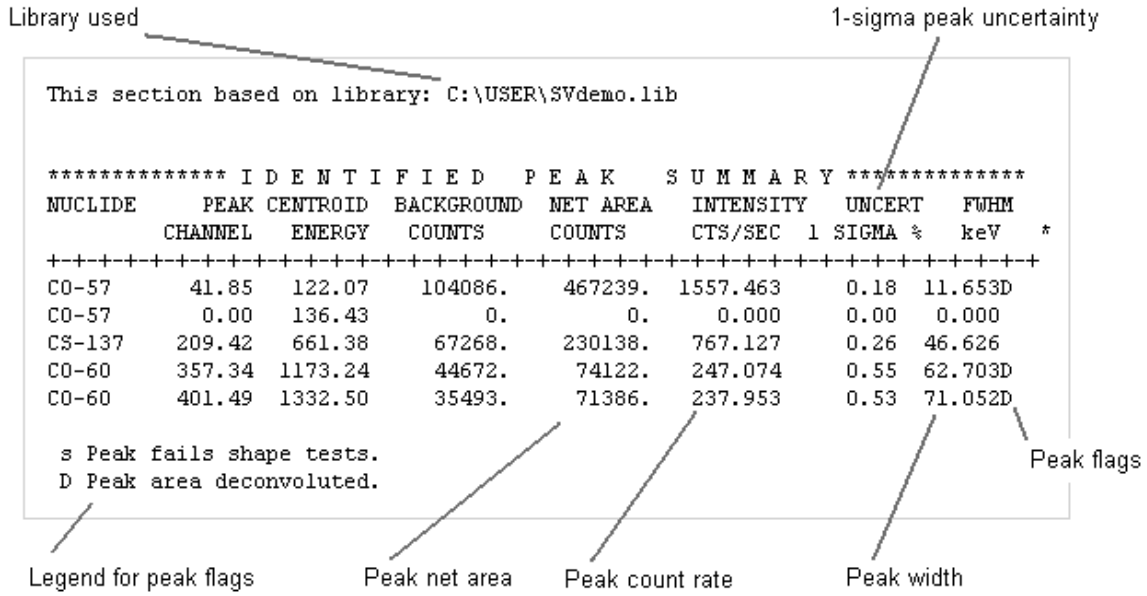

Library used
1-sigma peak uncertainty
This section based on library: C:\USER\SVdemo.lib
********** I D E N T I F I E D P E A K S U M M A R Y **********
NUCLIDE PEAK CENTROID BACKGROUND NET AREA INTENSITY UNCERT FWHM
CHANNEL ENERGY COUNTS COUNTS CTS/SEC 1 SIGMA % keV *
CO-57 41.85 122.07 104086. 467239. 1557.463 0.18 11.653D
CO-57 0.00 136.43 0. 0. 0.000 0.00 0.000
CS-137 209.42 661.38 67268. 230138. 767.127 0.26 46.626
CO-60 357.34 1173.24 44672. 74122. 247.074 0.55 62.703D
CO-60 401.49 1332.50 35493. 71386. 237.953 0.53 71.052D
s Peak fails shape tests.
D Peak area deconvoluted.
Peak flags
Legend for peak flags
Peak net area
Peak count rate
Peak width

Fig. 190. Identified (Library) Peak List.

INTENSITY CTS/SEC

The next column shows either the net area divided by the live time to yield the counts/second for the peak, or the efficiency at this energy times the peak area. See Section B.5.2. for instructions on selecting one or the other.

UNCERTAINTY

The next column shows the counting uncertainty for this net peak area. All library peaks are reported, even if their error exceeds the input sensitivity cutoff.

PEAK WIDTH

The next column shows the FWHM of the net peak area.

The last column shows a symbol if the peak is too wide or too narrow as compared to the shape calibration, or a different symbol if the peak area was deconvoluted. Otherwise it is blank. The symbol explanations are printed at the bottom of the list.

7.4. Library Peak Usage

Figure 191 shows the isotope/peak matrix or summary of library peak usage. You can suppress this section. It is not available if the library is not found or the spectrum is not efficiency calibrated. If library-based peak stripping is enabled, there will be a separate list for the two analysis libraries. The library name is printed at the beginning of the list.

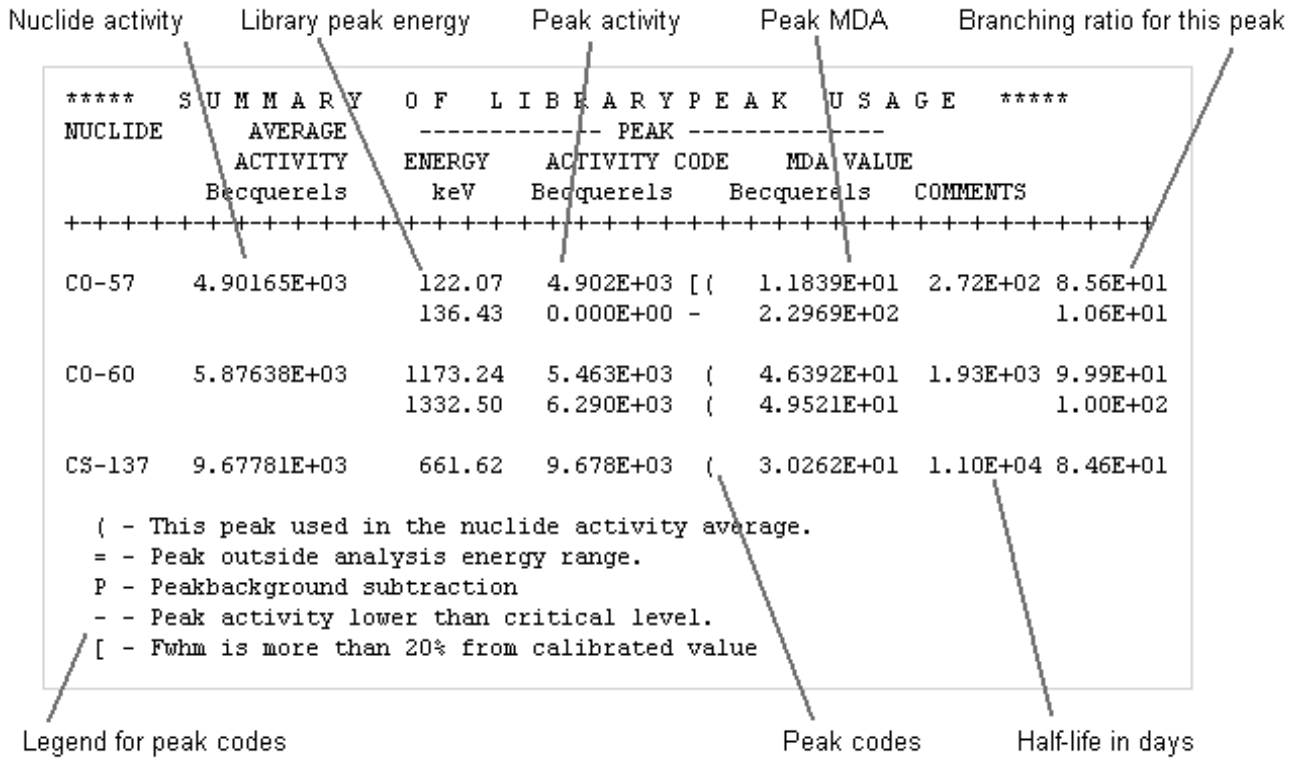

Nuclide activity
Library peak energy
Peak activity
Peak MDA
Branching ratio for this peak
***** SUMMARY OF LIBRARY PEAK USAGE *****
NUCLIDE AVERAGE ACTIVITY PEAK ENERGY ACTIVITY CODE MDA VALUE COMMENTS
Becquerels keV Becquerels Becquerels
CO-57 4.90165E+03 122.07 4.902E+03 [(1.1839E+01 2.72E+02 8.56E+01
136.43 0.000E+00 - 2.2969E+02 1.06E+01
CO-60 5.87638E+03 1173.24 5.463E+03 (4.6392E+01 1.93E+03 9.99E+01
1332.50 6.290E+03 (4.9521E+01 1.00E+02
CS-137 9.67781E+03 661.62 9.678E+03 (3.0262E+01 1.10E+04 8.46E+01
(- This peak used in the nuclide activity average.
= - Peak outside analysis energy range.
P - Peakbackground subtraction
- - Peak activity lower than critical level.
[- Fwhm is more than 20% from calibrated value
Legend for peak codes
Peak codes
Half-life in days

Fig. 191. Library Peak Use Summary.

NUCLIDE

The first column shows the nuclide name. These are arranged in library order. The nuclides are separated by a blank line.

AVERAGE ACTIVITY

The second column shows the average activity in becquerels or other units. This number has not been normalized by the scaling factors, but does include the decay during acquisition correction.

ENERGY keV

The third column shows the peak energies for each nuclide, in the library order. This is the library energy.

ACTIVITY

The next column shows the activity based only on this peak. For a nuclide with only one peak, this is the same as the entry in column 2.

MDA FOR THIS PEAK

This is the MDA for this nuclide based on this peak only.

HALF LIFE IN DAYS
This is the half-life for this nuclide in days. This and the next column can be suppressed by modifying G30WINDS.INI (Section A.2.2).

BRANCHING RATIO
This is the yield for this energy for this isotope. See Half-life.

PEAK CODE
The next column might contain a symbol which shows whether or not the peak passed various tests. These symbols can be used to determine how to change the analysis in order to obtain better results.

The symbols have the following meanings:

% The 1-sigma counting error was greater than the user-set sensitivity cutoff value.

– The abundance for this peak was lower than the critical level.

P Peak background subtraction was done on this peak.

The next column might contain a symbol, **(** , that indicates which peaks were used in the average activity calculation for this nuclide. There might be a symbol in the previous column indicating that the peak did not pass a test, but if the **(** is present, it was used in the activity calculation.

COMMENTS
This column contains the half-life in days, followed by the yield. This might be overwritten by other messages.

7.5. Summary of Nuclides in Sample

Figure 192 shows the last page of the report, which lists the activity in the sample. If the spectrum is not efficiency calibrated or the library is not found, this table is suppressed. The nuclides are arranged in library order. The activity is the average activity multiplied by the scale factor. The column label is entered by the operator. If decay correction is requested, the decay-corrected activity is also printed. If the nuclide is not found, the MDA value is printed with a < symbol after the nuclide name, and no error.

The total activity is the scaled sum of the decay-corrected activity, if present, or the time-of-count activity. The MDA values are not included in the total.

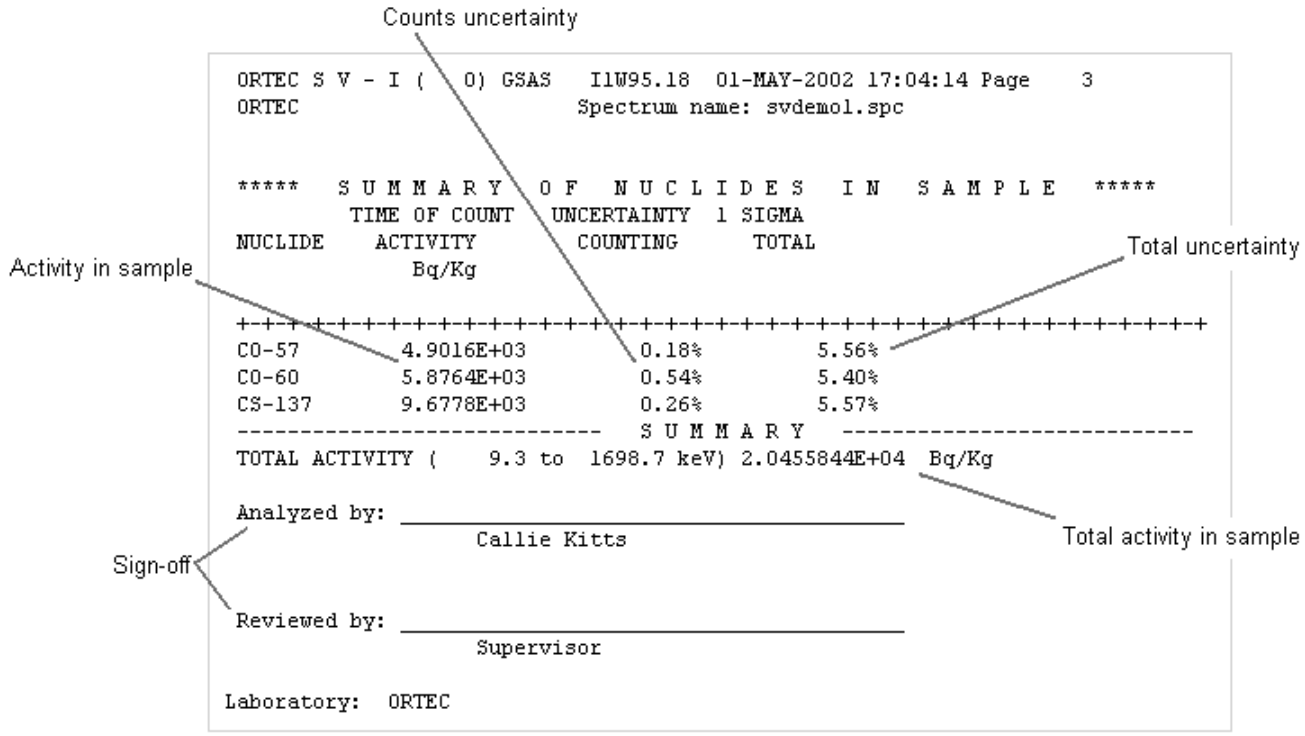

Counts uncertainty
Activity in sample
Total uncertainty
Total activity in sample
Sign-off
ORTEC S V - I (0) GSAS I1W95.18 01-MAY-2002 17:04:14 Page 3
ORTEC Spectrum name: svdemol.spc
***** S U M M A R Y O F N U C L I D E S I N S A M P L E *****
TIME OF COUNT UNCERTAINTY 1 SIGMA
NUCLIDE ACTIVITY COUNTING TOTAL
Bq/Kg
CO-57 4.9016E+03 0.18% 5.56%
CO-60 5.8764E+03 0.54% 5.40%
CS-137 9.6778E+03 0.26% 5.57%
S U M M A R Y
TOTAL ACTIVITY (9.3 to 1698.7 keV) 2.0455844E+04 Bq/Kg
Analyzed by:
Callie Kitts
Reviewed by:
Supervisor
Laboratory: ORTEC

Fig. 192. Final Analysis Summary.

8. QUALITY ASSURANCE

The accuracy and reproducibility of results of a data acquisition system should be verified on a periodic basis. Quality assurance (QA) in ScintiVision supplies a means for doing this in accordance with ANSI N13.30 and N42.14. The detector-shield background, detector efficiency, peak shape, and peak drift can be tracked with warning and acceptance limits. The latter use a check source. These results are stored in a database and can be displayed and charted. The database can be accessed with commercially available database products, including Microsoft Access. The information stored in the database for each detector includes:

- **Total Background** count rate (counts/sec), which is taken without a source. The background should be monitored to verify that the detector and shield have not been contaminated by radioactive materials. The value stored is the total count rate which is independent of the count time and any specific isotopic contamination. A background analysis report is printed after the analysis completes.

- **Total Activity** of all nuclide(s) for a given calibration source (decay corrected). The total activity of a calibration or check source checks the efficiency calibration currently in use and the general operating parameters of the system, including source positioning, contamination, library values, and energy calibration. This activity calculation uses the general analysis program to ensure that the total system is checked.

- **Average FWHM ratio** ($FWHM_{Spectrum}/FWHM_{Calibration}$) for a list of peaks present on a calibration source. The FWHM value checks the electronic noise and pole-zero adjustment of the amplifier. The peak shift checks to verify that the system gain and zero offset have not changed.

- **Average peak shift** (average of the deviation of actual peak centroids from expected library energies within a specified range.)

- (Optionally:) the **Actual centroid energies** of all the library peaks.

ORTEC Application Note 55 (see http://www.ortec-online.com/pdf/an55.pdf) contains more information and help on starting and running QA for gamma spectroscopy.

The three parts of QA in ScintiVision are:

1. Establishing and entering the settings, or “ground rules,” for QA.

2. Measuring background and sample. You perform this periodically, and it is automatically logged into a database by the program.

3. Analyzing the QA database and generating reports. This includes ScintiVision's **Status** and **Control Chart** features, which allow you to view the current status of measurements for the Detector and/or view and print the data stored in the database as a control-chart display.

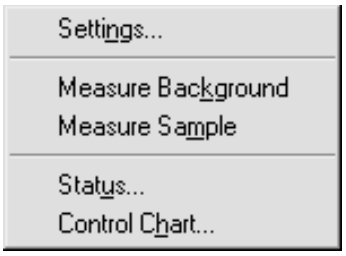


Fig. 193. QA Menu.

Figure 193 shows the **QA** submenu under the **Acquire** menu.

8.1. Settings...

The QA settings are the limits for the acceptance of the results of the QA data. That is, if the QA result is outside of these limits, the system is not in correct operation. ScintiVision has ***warning*** and ***alarm*** limits, determined respectively by the **Low/High** and **Minimum/Maximum** values you enterin the Quality Assurance Settings dialog. If the QA result is outside the warning limits, a warning dialog will be displayed. If the QA result is outside the alarm limits, a warning dialog will be displayed and, if the **Lock Acquire on Violation(s)** box has been checked, the problem must be corrected and QA rerun before more data can be collected on that Detector.

Generally, after setup these levels should not be changed without careful consideration. Use the ScintiVision menu password security mechanism (**Services/Menu Passwords...**) to protect this menu from unauthorized access.

The first time the **Settings...** command is used, a QA database must be created. Should the dialog shown in Fig. 194 will open, click on **Yes**. This will start the easy-to-use database-setup wizard discussed in Section 8.1.2.

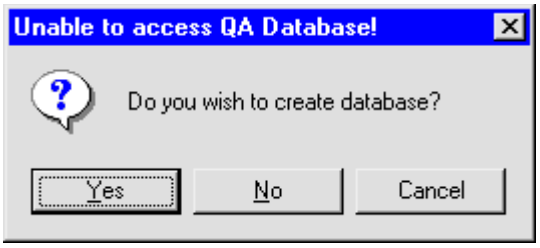


Fig. 194. Create QA Database.

8.1.1. Establishing QA Settings

Once the QA database has been created, click on **Settings...** to open the **Quality Assurance Settings** dialog shown in Fig. 195.

This dialog contains three main data-entry areas:

- **BACKGROUND Acquisition/Count Rate Limits**
- **SAMPLE Type Analysis Settings File**
- **SAMPLE Analysis Parameter Limits**

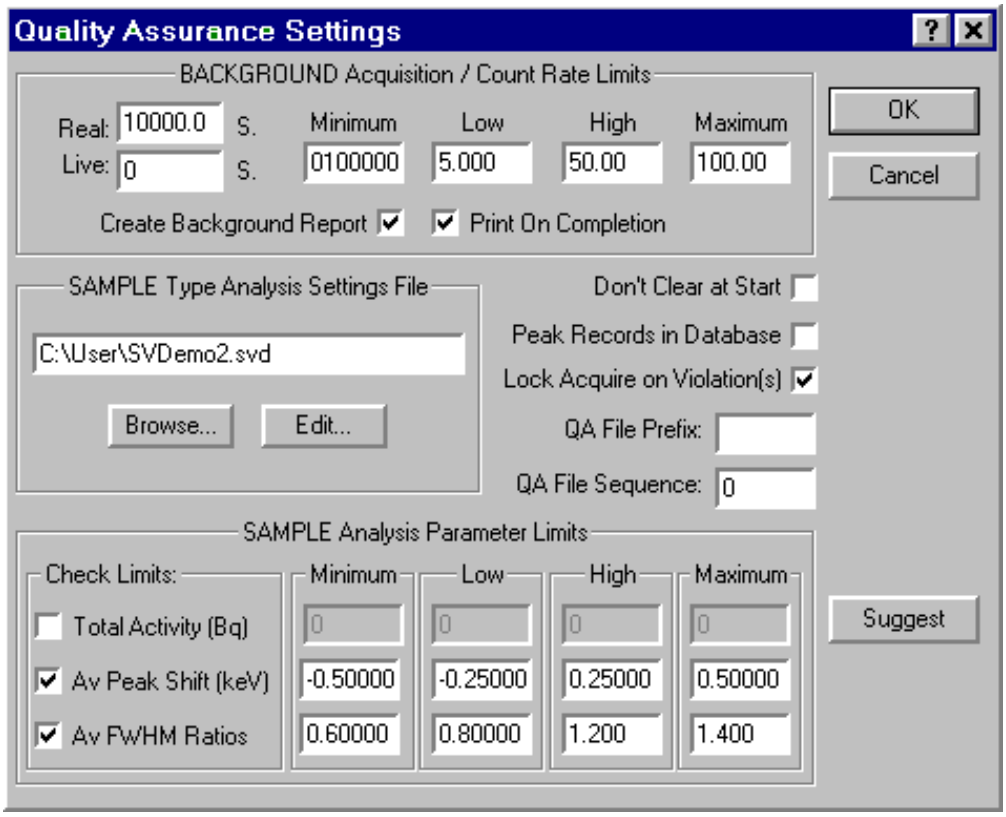


Fig. 195. QA Settings Dialog.

In order to determine the settings for QA, several preliminary steps must be taken:

1. Backgrounds must be counted to determine reasonable levels.

2. Samples must be counted for total activity to obtain expected values, since total activity is detector and QA source dependent.

3. A QA library containing only the nuclides in the QA source must be created using the nuclide library editor (see Section 5.6).

4. A sample type settings file (`.SVD`) must be created which contains the defaults for the QA acquisition and analysis (see Section 5.5.1.1).

5. A database to contain the QA results must be created (see Section 8.1).

All the information gathered in preliminary Steps 1–4 can be entered in the **Quality Assurance Settings** dialog.

The **BACKGROUND Acquisition** time and **Count Rate Limits** are entered using the information gathered in Step 1 above. Enter the **Real** time or **Live** time in seconds; for background spectra, the dead time is near zero, so these are usually equal.

The **Minimum** and **Maximum** count-rate limits are the ***acceptance thresholds*** for the alarm limit. Acceptance thresholds are used to indicate that the system is operating far from the expected conditions, and can be used to prevent data acquisition from being performed at all until the condition is corrected. If the **Lock Acquire on Violation(s)** box is checked and an acceptance threshold is exceeded, the Detector is automatically locked out from use until the problem is corrected and QA is rerun. The **Low** and **High** count-rate limits are the warning limits, and exceeding them will cause warning messages to be displayed.

The **SAMPLE Type Analysis Settings File** is the **`.SVD`** file created for QA in Step 4 using **Analyze/Settings/Sample Type...**. Click on **Browse...** to select the **`.SVD`** file. To edit the **`.SVD`** file, click on **Edit...**. This will open the dialog for **Analyze/Settings/Sample Type...** (Section 5.5.1.1). Especially relevant sample-type settings include:

- Sample type **description**
- Acquisition **presets**
- **QA nuclide library** file (the one created in Step 3)

On the left of the **SAMPLE Analysis Parameter Limits** section are check boxes for marking the limits to be tracked. **Total Activity (Bq)**, **Av**erage **Peak Shift (keV)**, and **Av**erage **FWHM Ratios** are the choices. Click on the ones to be tracked. The first time ScintiVision QA is set up, click on the **Suggest** button (on the right) to enter factory-set limits. After this, use the **Suggest** button with caution, because clicking on it again will reset all the limits to the factory settings. The actual limits can be determined from the samples counted in Step 2 above.

To write the QA analysis results to disk, mark the **Create Background Report** checkbox. This activates the **Print on Completion** checkbox; mark it to simultaneously print a report hardcopy. QA background reports are assigned names according to this format:

`QAB_[Detector name]_99999.rpt`

where **`QAB`** indicates a background report, **`[Detector name]`** is the Detector name assigned in the MCB Configuration program, and **`99999`** indicates a five-digit number. QA sample reports have a similar name format, except that they begin with **`QAS`** instead of **`QAB`**. These report names are assigned by ScintiVision, and users cannot change the name format. The report names are not captured into the QA database.

Click on **OK**. ScintiVision will check the measurement limits to determine if they are set consistently. If they are, the dialog will close; if not, a message will be displayed on the Marker Information Line and the dialog will remain open so the limits can be changed. QA data can now be collected using **Acquire/QA/Measure Background** and **Acquire/QA/Measure Sample**.

8.1.2. Creating the QA Database

Figure 196 shows the first wizard screen. Mark the ***second*** radio button, **User Data Source (Applies to this machine only)**. Click on **Next**.

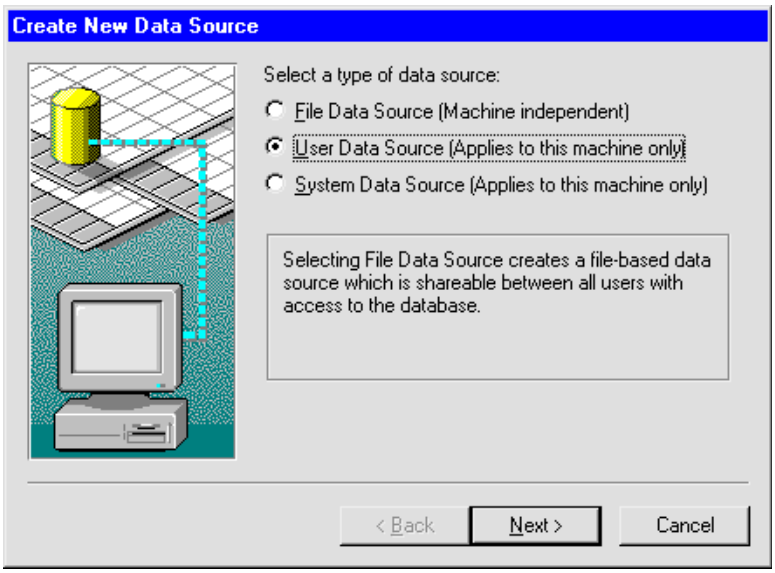

Create New Data Source
Select a type of data source:
File Data Source (Machine independent)
User Data Source (Applies to this machine only)
System Data Source (Applies to this machine only)
Selecting File Data Source creates a file-based data source which is shareable between all users with access to the database.
< Back
Next >
Cancel

Fig. 196. First QA Database Wizard Screen.

The second wizard screen is shown in Fig. 197. Leave the highlight on the first entry, **Microsoft Access Driver (*.mdb)**, then click on **Next**.

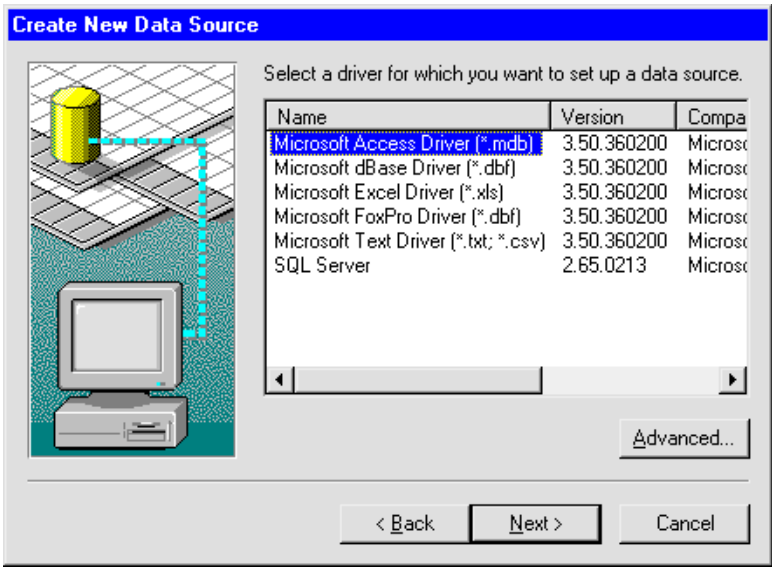


Fig. 197. Second QA Database Wizard Screen.

Figure 198 shows the setup summary on the final wizard screen. Click on **Finish**.

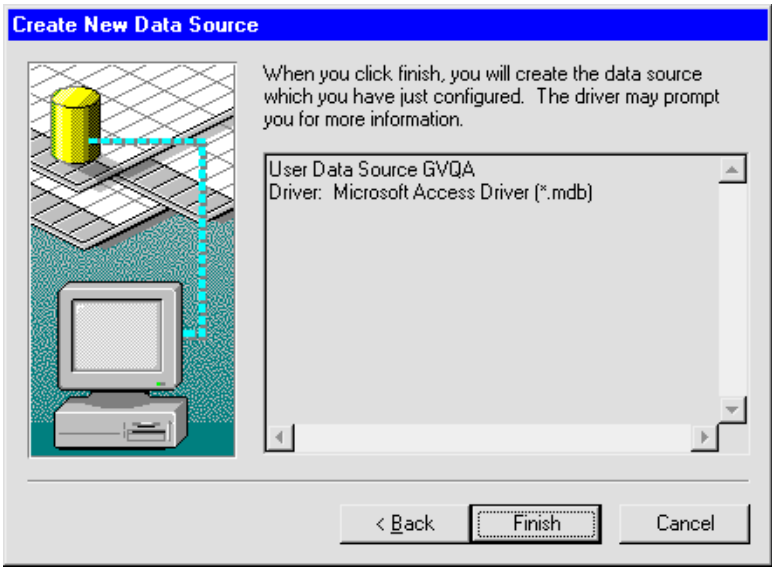

Create New Data Source
When you click finish, you will create the data source which you have just configured. The driver may prompt you for more information.
User Data Source GVQA
Driver: Microsoft Access Driver (*.mdb)
< Back
Finish
Cancel

Fig. 198. Final Wizard Screen.

The last setup screen is shown in Fig. 199. Click on **OK**; the Quality Assurance Settings dialog (Fig. 195) will open. At this point, the database is ready and QA setup and measurements can proceed.

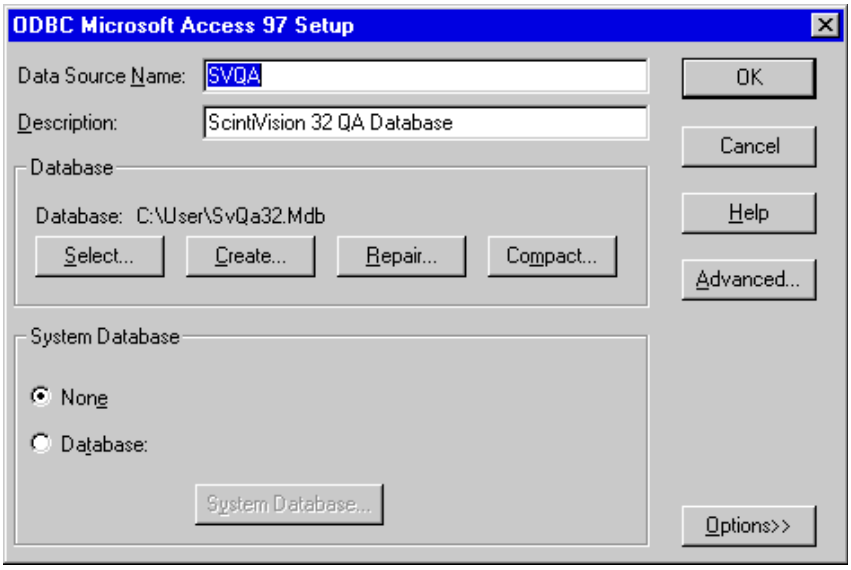


Fig. 199. Select Database.

8.2. Measure Background

This command opens the dialog in Fig. 200, which tells you to remove all sources from the Detector before proceeding. Confirm that all sources have been removed for a background measurement, click on **OK–Start**. The remaining functions are performed automatically.

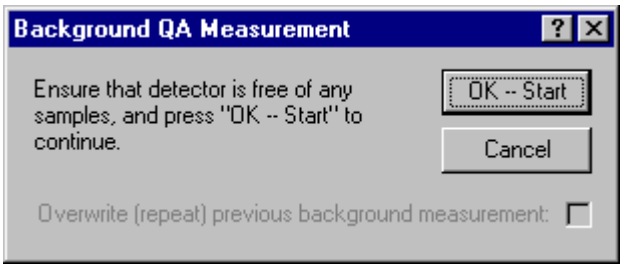

Background QA Measurement
Ensure that detector is free of any samples, and press "OK -- Start" to continue.
OK -- Start
Cancel
Overwrite (repeat) previous background measurement:

Fig. 200. Begin Count for Background QA.

Mark the **Overwrite (repeat) previous background measurement** check box (click on it) if the previous measurement was in error. For example, if a problem was detected and fixed, and this run is to verify the repairs, check the box so the “bad” value is not kept in the database. Click on **OK**.

If the background is outside the set limits, a warning similar to Fig. 201 is displayed.

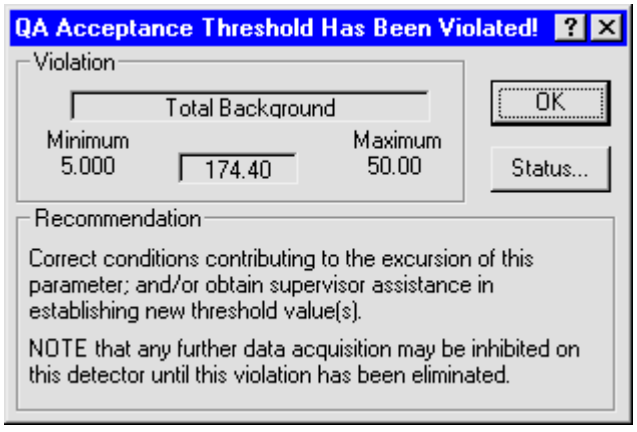

QA Acceptance Threshold Has Been Violated!
Violation
Total Background
Minimum
5.000
174.40
Maximum
50.00
OK
Status...
Recommendation
Correct conditions contributing to the excursion of this parameter; and/or obtain supervisor assistance in establishing new threshold value(s).
NOTE that any further data acquisition may be inhibited on this detector until this violation has been eliminated.

Fig. 201. Background Warning Message.

8.3. Measure Sample

This command opens the Sample QA Measurement dialog (Fig. 202). It contains a reminder to place the QA source on the Detector. Click on **Overwrite** to replace the last measurement. Click on **OK–Start** to begin the count.

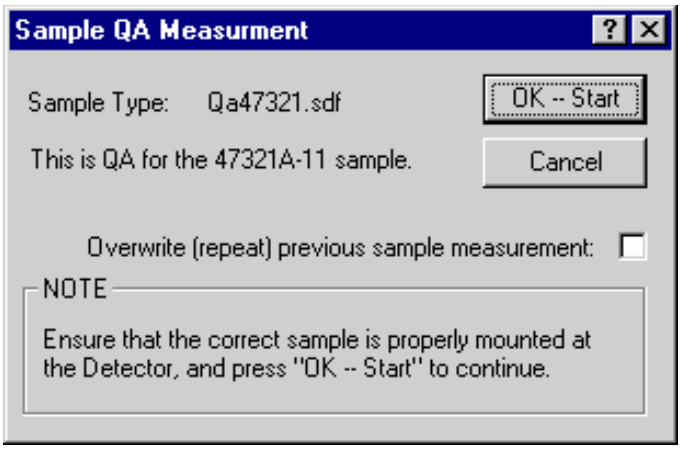

Sample QA Measurment
Sample Type: Qa47321.sdf
OK -- Start
This is QA for the 47321A-11 sample.
Cancel
Overwrite (repeat) previous sample measurement:
NOTE
Ensure that the correct sample is properly mounted at the Detector, and press "OK -- Start" to continue.

Fig. 202. Starting Sample Type QA Measurement.

The QA source spectra are collected for the preset time and analyzed automatically. The analysis results are compared with the limits. If the result is outside the limits, a warning is displayed. The results are also stored in the QA database.

8.4. Status...

The QA status for the currently selected Detector is displayed as shown in Fig. 203. Click on **OK** to close the dialog.

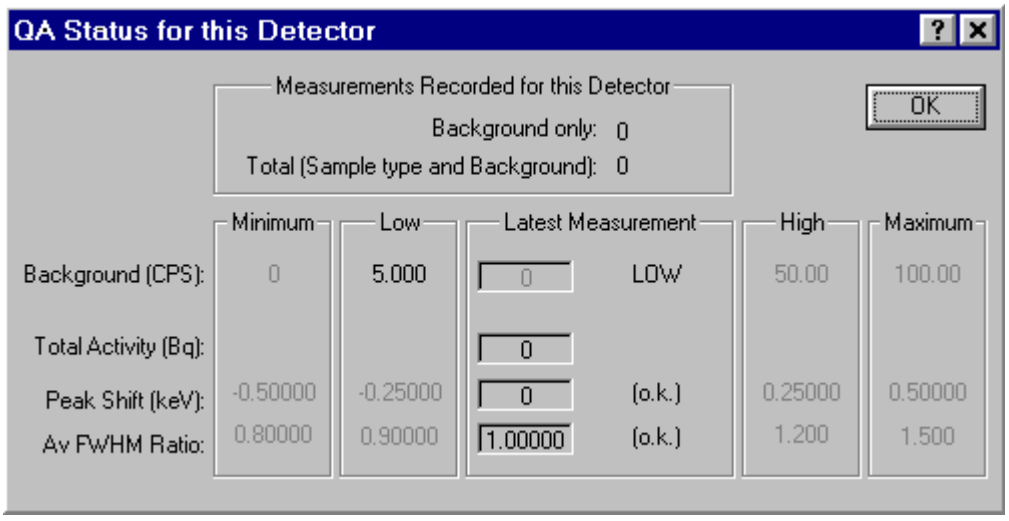


Fig. 203. Showing Status of QA Measurements for a Detector.

8.5. Control Charts...

The **Control Chart...** functions display the data stored in the QA database as a control chart. The displayed data can be scrolled backward or forward across the screen so that all collected data can be viewed. A typical chart is shown in Fig. 204. The short dashed lines represent the warning limits and the long dashed lines represent the acceptance threshold limits.

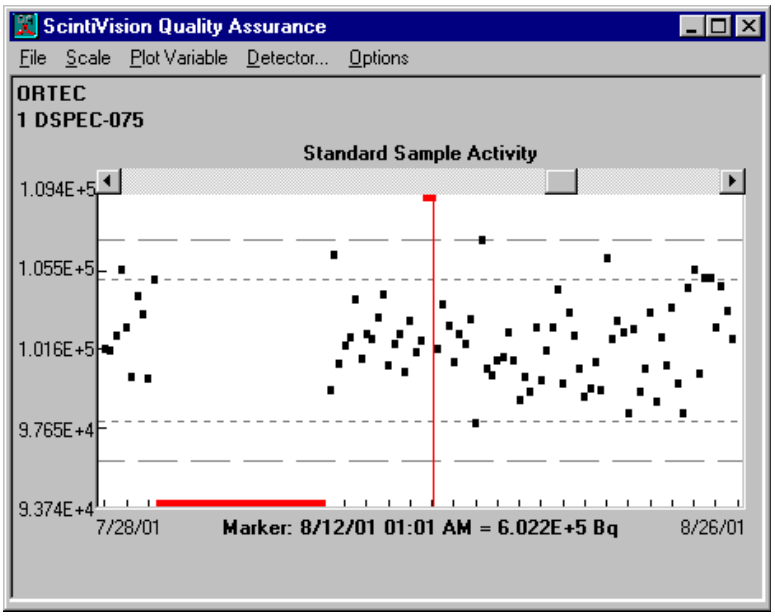


Fig. 204. Control Chart Example.

Figure 205 shows the control chart's **File** menu, which contains the **Print Graph** command for printing the current graph on the current printer; a standard Windows **Print Setup...** command that allows you to select the printer and its setup features, such as landscape vs. portrait layout, paper size, number of copies, and device control options; the **Exit** command for closing the QA Chart Program (this duplicates the dialog's upper-right Close box); and an **About** box providing version information about the chart program.

Choose the chart's time period (**Week**, **Month**, or **Quarter**) from the **Scale** menu (Fig. 206).

The **Plot Variable** menu (Fig. 207) contains functions for selecting **Activity**, **Peak Energy**, **Peak Width @ Half Max**, or **Background**.

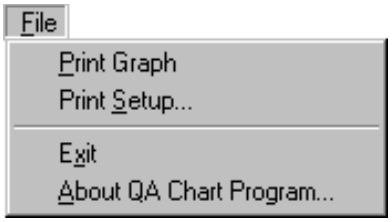


Fig. 205. QA Chart File Menu.

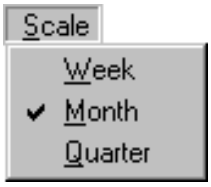


Fig. 206. Scale Menu.

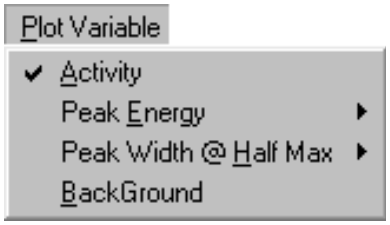


Fig. 207. Plot Variable Menu.

The **Detector** menu item opens the list of Detectors for which background and sample measurements have been made (Fig. 208). Select a Detector for this control chart and click on **OK**.

You can perform additional off-line processing of the QA database (including detailed trend analyses) outside of ScintiVision. The database format used is well-documented and compatible with a number of popular software products including Microsoft Access.

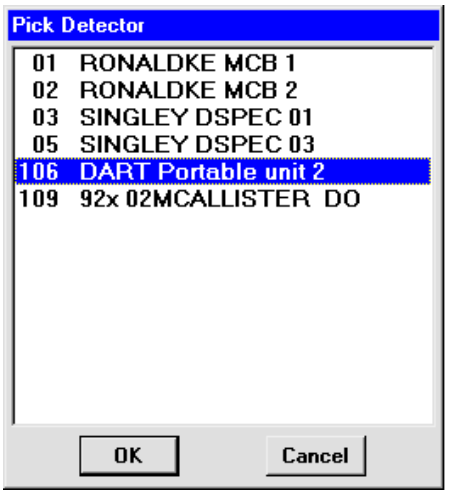


Fig. 208. Detector Pick List.

NOTE ***We strongly recommend that you back up any ScintiVision database files before performing manipulations on them outside of ScintiVision.***

The **Options** menu (Fig. 209) includes an **Always On Top** command, which keeps the QA window on top of all other windows, no matter which window (in ScintiVision or any other program) might be active.

The **Fixed Vertical Scale** command adds flexibility in displaying control charts both on-screen and on printouts, for comparison with other charts.

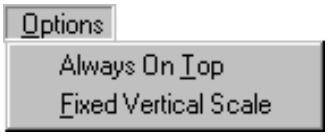


Fig. 209. QA Chart File Menu.

- **Fixed Vertical Scale Off** (no check mark) — In this mode, the vertical scale of the graph is adjusted so that all points are shown to scale. All points are black. If one or more data points are substantially out of range, the graph could be quite compressed vertically.

- **Fixed Vertical Scale On** (check mark) — In this mode, the vertical scale of the graph is set to show the upper and lower alarm limits as full scale. The data points within the alarm limits are colored black. Out-of-range points are displayed in red at the lower or upper limits of the graph, at the proper horizontal coordinate. The out-of-range points are printed as a *question mark* (**?**).

To switch between the two display modes, click on the menu item to mark it with a checkmark or unmark it.

Figures 210 through 213 show the screen and printout for a QA data set with **Fixed Vertical Scale** on, then off. Compare the location of the points that exceed alarm limits in Figs. 210 and 211 to the location of the question marks in Figs. 212 and 213.

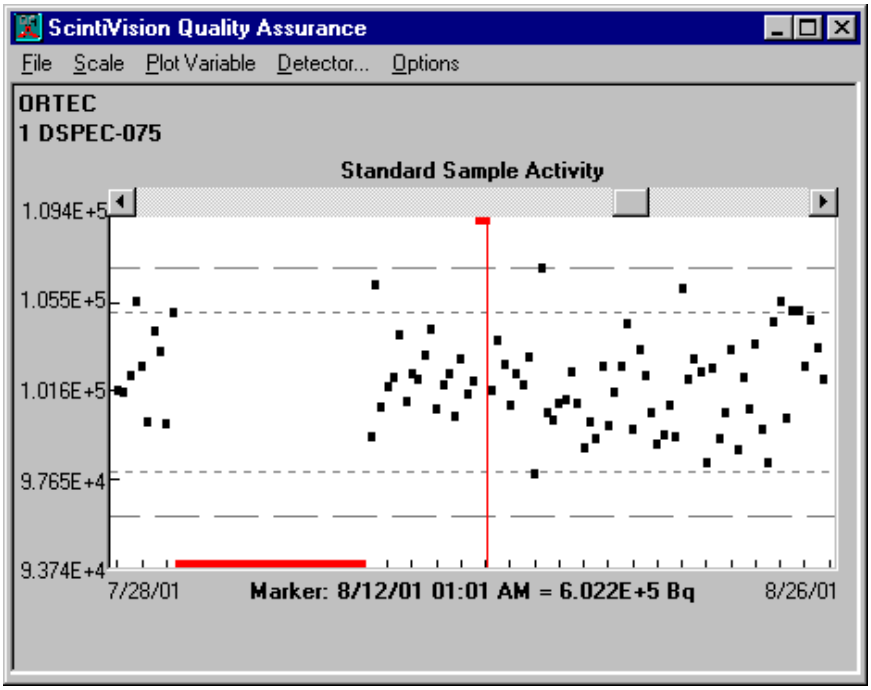


Fig. 210. Control Chart On Screen with Fixed Vertical Scale On.

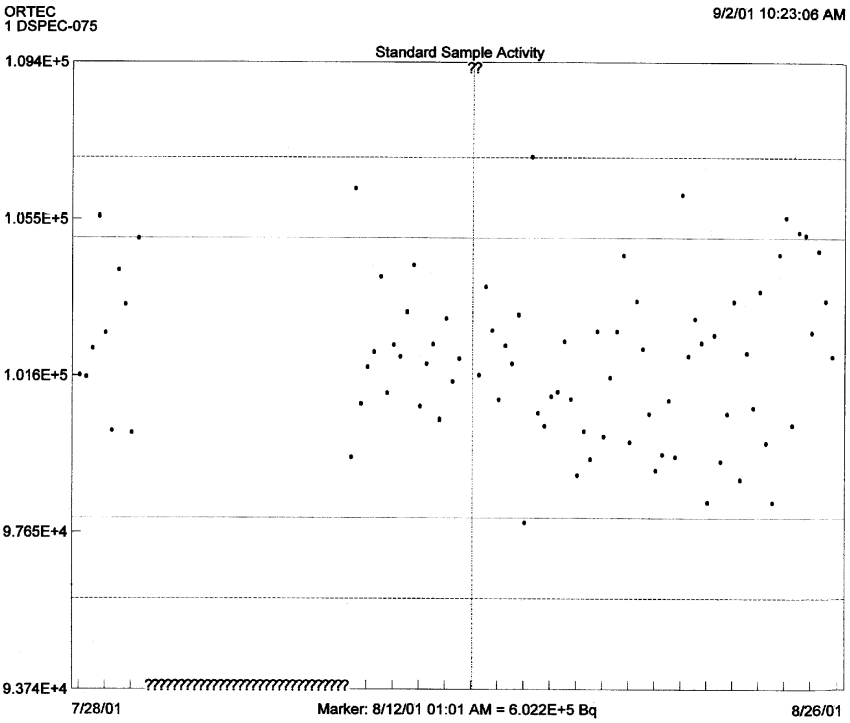


Fig. 211. Printout of Control Chart with Fixed Vertical Scale On.

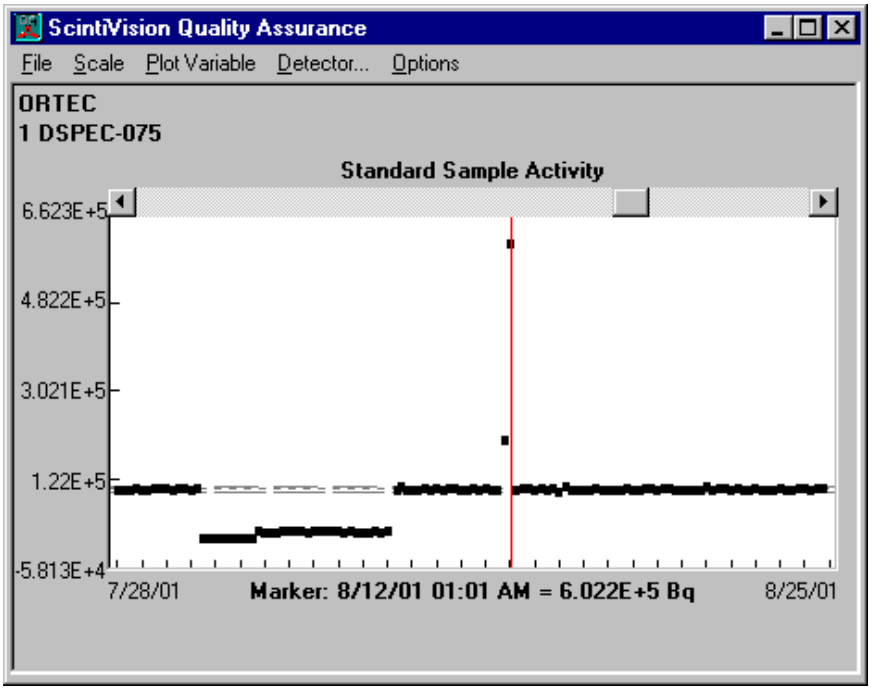


Fig. 212. Control Chart On Screen with Fixed Vertical Scale Off.

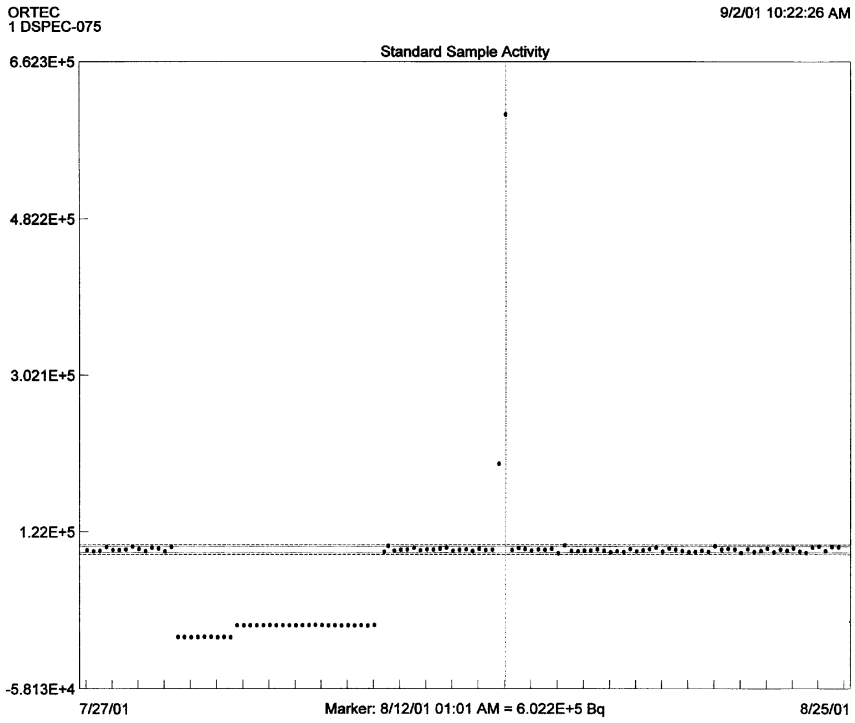


Fig. 213. Printout of Control Chart with Fixed Vertical Scale Off.

9. KEYBOARD FUNCTIONS

This chapter describes the ScintiVision accelerator keys. The keys described in this section are grouped primarily according to location on the keyboard and secondarily by related function.

9.1. Introduction

Table 6 provides a quick reference to all of the ScintiVision keyboard and keypad functions. These accelerators are also illustrated in Fig. 214, and discussed in more detail in the remainder of the chapter.

The accelerators are available only in the ScintiVision window. The Title Bar must be highlighted with the active title bar color (as set up in Windows Control Panel). In addition, the active cursor — or input *focus* — must be in the spectrum window. Similar to other Windows applications, the focus can be switched between ScintiVision and other applications by clicking on the Windows Taskbar, pressing <**Alt + Tab**>, or, if the inactive window is visible, pointing with the mouse at some spot in the inactive window and clicking.

The multi-key functions, such as <**Alt + 1**> or <**Shift + →**>, are executed by holding down the first key (e.g., <**Alt**>, <**Shift**>, or <**Ctrl**>) while pressing the key that follows the "+" sign in the brackets, then releasing both keys simultaneously. Functions that use the keypad keys begin with the word **Keypad**, e.g., **Keypad**<**5**>.

As usual for any Windows application, the menus are accessed by clicking on them with the mouse, or by using the **Alt** key plus the key that matches the underlined letter in the menu item name. For example, the multi-key combination to activate the **File** menu is <**Alt + F**>.

Note that the ScintiVision accelerator keys do not interfere with Windows menu operations or task switching. For example, when a menu is active (i.e., pulled down), the <←>/<→> and <↑>/<↓> keys revert to their normal Windows functions of moving across the menu bar and scrolling up/down within a menu, respectively. As soon as the menu is closed, they behave as ScintiVision accelerators again.

9.2. Marker and Display Function Keys

9.2.1. Next Channel <→>/<←>

When not in rubber-rectangle mode, the right and left arrow keys move the marker by one displayed pixel in the corresponding direction. This can represent a jump of more than one spectral data memory channel, especially if the horizontal scale in channels is larger than the width in pixels of the window (see the discussion in Section 4.1).

Table 15. Quick Reference to ScintiVision Keyboard Commands.

Key	Function
<↓> or <F5>	Change vertical scale so spectrum peaks are smaller.
<↑> or <F6>	Change vertical scale so spectrum peaks are larger.
<↓>	In rubber rectangle mode, shift rectangle down (toward baseline) one pixel
<↑>	In rubber rectangle mode, shift rectangle up (away from baseline) one pixel.
<→>	Move marker to higher channel. In rubber rectangle mode, shift rectangle right one pixel.
<←>	Move marker to lower channel. In rubber rectangle mode, shift rubber rectangle left one pixel.
<–> or <F7>	Narrow the horizontal scale.
<+> or <F8>	Widen the horizontal scale.
<Ctrl + →>	Jump to next higher peak.
<Ctrl + ←>	Jump to next lower peak.
<Shift + →>	Jump to next higher ROI.
<Shift + ←>	Jump to next lower ROI.
<Alt + →>	Advance to next library entry.
<Alt + ←>	Recede to previous library entry.
<PageUp>	Jump to higher channel number in 1/16th-screen-width increments.
<PageDown>	Jump to lower channel number in 1/16th-screen-width increments.
<Home>	Jump to first channel of the full spectrum.
<End>	Jump to last channel of the full spectrum.
<Ctrl + Fi>	Select Detector i (i = 1 to 12, in pick list order).
<F2>	Switch ROI bit control from OFF to SET to CLEAR.
<F3>	In DSPEC Plus, switch between the two spectra stored in ZDT mode.
<Shift + F3>	In DSPEC Plus, switch the disk spectrum to compare normal to disk ZDT spectrum or ZDT spectrum to disk normal spectrum.
<F4> or <Alt + 6>	Switch between displaying selected Detector and buffer.
<F5> or <↓>	Change vertical scale so that spectrum peaks are smaller.
<F6> or <↑>	Change vertical scale so that spectrum peaks are larger.
<F7> or <–>	Narrow the horizontal scale.
<F8> or <+>	Widen the horizontal scale.
<Alt + F7>	Reset both horizontal and vertical scaling to view complete spectrum.
Keypad<–>	Zoom out.
Keypad<+>	Zoom in.
Keypad<5>	Center expanded display on cursor.
Keypad</>	Switch to logarithmic vertical scale.
Keypad<*>	Switch to auto vertical scale.
Insert<Ins>	Mark the peak region around the cursor as an ROI.
Delete<Del>	Clear the ROI.
<Shift + ↑>	Shift the compare spectrum upwards.
<Shift + ↓>	Shift the compare spectrum downwards.
<Alt + 1>	Start acquisition in selected Detector.
<Alt + 2>	Stop acquisition in selected Detector.
<Alt + 3>	Clear data in selected Detector.
<Alt + 5>	Copy data in the selected Detector to the buffer.
<Alt + 6> or <F4>	Switch between displaying selected Detector and buffer.
<Alt + –>	Decrease amplifier fine gain by smallest increment (where supported).
<Shift + Alt + –>	Decrease amplifier fine gain by several increments.
<Alt + +>	Increase amplifier fine gain by smallest increment.
<Shift + Alt + +>	Increase amplifier fine gain by several increments.
<PrintScreen>	Capture screen to Windows Clipboard.

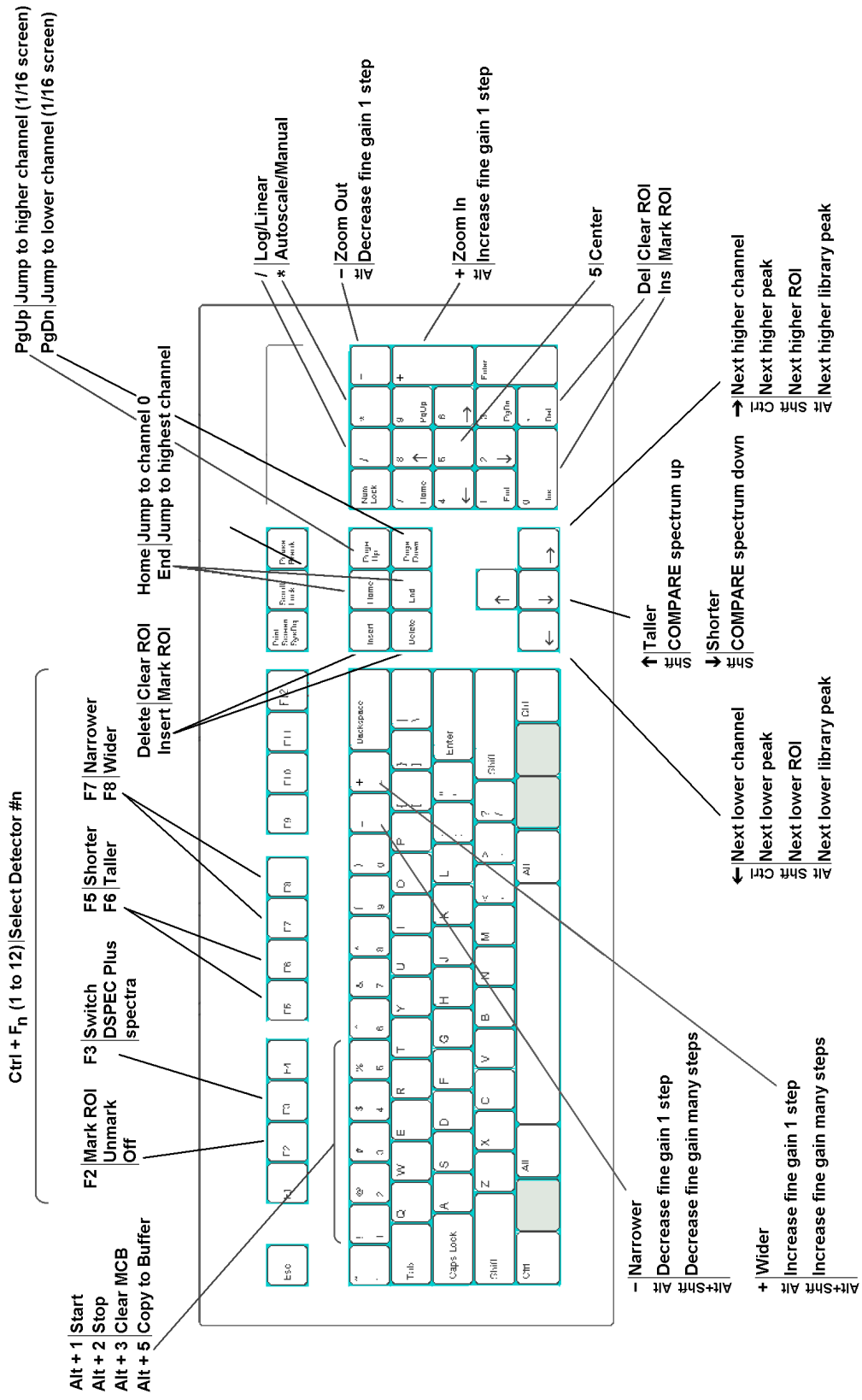


Fig. 214. ScintiVision Keyboard and Keypad Accelerators.

If the horizontal scale is expanded, when the marker reaches the edge of the spectrum window, the next key press past the edge shifts the window to the next block of channels in that direction such that the marker is now in the center of the display.

When the ROI mode is set to **Mark**, the <→>/<←> keys cause the channels to be marked as the marker moves. Similarly, they clear the ROI bits while the ROI mode is **UnMark**. (See Section 5.8.)

9.2.2. Next ROI <Shift + →>/<Shift + ←>

The <**Shift** + →> or <**Shift** + ←> move the marker to the beginning of the next higher channel ROI, or the end of the preceding ROI, respectively, of the displayed spectrum. These functions are duplicated by the **ROI** indexing buttons on the Status Sidebar.

9.2.3. Next Peak <Ctrl + →>/<Ctrl + ←>

The <**Ctrl**+ →> and <**Ctrl**+ ←> keys perform a peak search on the spectrum in the higher or lower channel direction, respectively, and move the marker to the first peak found. If no peak is found, the program displays the "**No More Peaks**" message and the marker does not move. If the spectrum is energy-calibrated and the library loaded, the system displays the best match from the library within two FWHMs of the peak centroid. If there is no match within this range, the "**No Close Library Match**" message is displayed. These functions are duplicated by the **Peak** indexing buttons on the Status Sidebar.

9.2.4. Next Library Entry <Alt + →>/<Alt + ←>

These keys move forward or backward through the nuclide library to the next closest library entry. Each button press advances to the next library entry and moves the marker to the corresponding energy. Also, instead of indexing from a previously identified peak, the marker can be positioned anywhere in the spectrum and these keys used to locate the entries closest in energy to that point. If a warning beep sounds, it means that all library entries have been exhausted in that direction, or that the spectrum is not properly calibrated for reaching the energy with the marker. In any case, if an appropriate peak is available at the location of the marker, data on the peak activity are displayed on the Marker Information Line. These functions are duplicated by the **Library** indexing buttons on the Status Sidebar.

9.2.5. First/Last Channel <Home>/<End>

These keys move the marker to the first or last channel of the spectrum.

9.2.6. Jump (Sixteenth Screen Width) <PageDown>/<PageUp>

<**PageDown**> and <**PageUp**> jump the marker position to the left (to lower channel numbers) or right (to higher channel numbers), respectively, 1/16 of the window width, regardless of the horizontal scale. The status of the ROI bit is not altered when the marker is moved with these keys, that is, the **Mark/UnMark/Off** state is ignored. The marker channel contents and Marker Information Line are continuously updated as the marker jumps, so when the jump is complete, the marker information is up-to-date for the current channel.

9.2.7. Insert ROI <Insert> or Keypad<Ins>

These keys mark an ROI in the spectrum, at the marker position, in one of two ways:

6. If the spectrum is calibrated, the region is centered on the marker with a width of three times the calibrated FWHM. There does not need to be a peak at the marker position.

7. If the spectrum is not calibrated, the region is centered on the peak, if any, located within two channels of the marker and is as wide as the peak. If the peak search fails, or if the peak is not well-formed, no ROI is marked. There is no limit on the size of a peak or ROI; therefore, in some uncalibrated spectra, large ROIs could be marked.

These accelerators duplicate the function of the **Mark ROI** Toolbar button and the **ROI/Mark Peak** menu selection (see Section 5.8).

NOTE <**Insert**> and **Keypad**<**Ins**> work conveniently in combination with <**Ctrl** + ←> and <**Ctrl** + →> to rapidly set peak ROIs.

9.2.8. Clear ROI <Delete> or Keypad<Del>

<**Delete**> and **Keypad**<**Del**> clear the ROI bits of all ROI channels contiguous to the channel containing the marker. These accelerators duplicate the function of the **Clear ROI** button on the Toolbar and the **ROI/Clear** menu selection (see Section 5.8).

9.2.9. Taller/Shorter <↑>/<↓>

When not in rubber-rectangle mode, the <↑> and <↓> keys decrease or increase the vertical full scale of the displayed spectrum so the peaks appear taller or shorter, respectively. The minimum is 16 counts-full-scale; the maximum is 1024 million counts. Each successive key press doubles or halves the full scale until the maximum or minimum is reached. Whenever the maximum full-scale value is reached, the next <↑> key press switches to logarithmic scale. If the display is already in logarithmic scale, the display switches to linear scale. In either case, the vertical full-scale value is always shown on the Toolbar.

Note that if the number of counts exceeds the full-scale value, the data points will be displayed at the full-scale value.

These keys duplicate the function of the <**F6**>/<**F5**> keys.

9.2.10. Move Rubber Rectangle One Pixel <↑>/<↓>/<→>/<←>

In rubber-rectangle mode (see Section 4.3.3), the arrow keys move the rubber rectangle one channel or one pixel at a time.

9.2.11. Compare Vertical Separation <Shift+↑>/<Shift+↓>

In Compare mode, the <**Shift** + ↑> or <**Shift** + ↓> keys decrease or increase the vertical separation between the two spectra. Each successive key press will increase or decrease the separation by moving the spectrum read from disk. The spectrum from disk can be moved below the first spectrum if it has fewer counts.

9.2.12. Zoom In/Zoom Out Keypad<+>/<–>

Keypad<+> increases the scale of both axes in the Expanded Spectrum View so the peaks appear larger, while **Keypad**<–> does the opposite, making the peaks look smaller. The scale value for both axes is always shown on the Toolbar.

These functions are duplicated by the **Zoom In**/**Zoom Out** buttons on the Toolbar and **Zoom In** and **Zoom Out** under the **Display** menu. See Section 4.1 for a more detailed discussion.

9.2.13. Fine Gain <Alt + +>/<Alt + –>

These accelerators step the internal amplifier up or down by one increment of fine gain on the selected Detector, if it has a software-controlled amplifier. The new fine gain setting is shown on the Supplemental Information Line at the bottom of the screen. If the gain stabilizer is active, the display of the histogram data might not change.

The fine gain can also be set with **Acquire/MCB Properties...** (Section 5.2.10), <**Shift** + **Alt** + +>/<**Shift** + **Alt** + –> on the keyboard, and **Keypad**<**Alt** + +>/<**Alt** + –>.

9.2.14. Fine Gain (Large Move) <Shift + Alt + +>/<Shift + Alt + –>

<**Shift**+**Alt**+ +> and <**Shift**+**Alt**+ –> step the internal amplifier of the selected Detector (if it has a software-controlled amplifier) up or down by a large increment of fine gain. If the gain stabilizer is active, the display of the histogram data might not change.

The fine gain can also be set using **Acquire/MCB Properties...** (Section 5.2.10), <**Alt**+ +>/ <**Alt**+ −> on the keyboard, and **Keypad**<**Alt** + +>/ <**Alt** + −>.

9.2.15. Screen Capture <PrintScreen>

The <**PrintScreen**> key captures the entire monitor display to the Windows Clipboard, where it is available for use in other applications such as word processors, Windows Paint, etc. Some older keyboards require <**Alt** + **PrintScreen**> or <**Shift** + **PrintScreen**>.

A typical usage would be to set up the display as desired for the snapshot (you might wish to use **Display**/**Preferences**/**Spectrum Colors...** to select black or white for all areas rather than colors, since they produce clearer printouts), then press <**PrintScreen**>. Start the desired graphics or word processing application. Copy the image from the Clipboard with <**Ctrl** + **V**> or **Edit**/**Paste** (refer to the documentation for the graphics or word processing program). See the FullShot manual for other screen-capture and screen-printing methods.

9.3. Keyboard Number Combinations

NOTE Only the key*board* numbers will function in the following combinations. The key*pad* number keys will *not* perform these functions.

9.3.1. Start <Alt + 1>

<**Alt** + **1**> starts the acquisition in the selected Detector. Any presets desired must be entered before starting acquisition. This accelerator duplicates the **Start** Toolbar button, the **Start** command on the right-mouse-button menu, and **Acquire**/**Start**, discussed in Section 5.2.2.

9.3.2. Stop <Alt + 2>

<**Alt** + **2**> stops acquisition in the selected Detector. This duplicates the **Stop** Toolbar button, the **Stop** command on the right-mouse-button menu, and **Acquire**/**Stop**, discussed in Section 5.2.4.

9.3.3. Clear <Alt + 3>

<**Alt** + **3**> clears the displayed Detector's histogram data and its descriptors (e.g., real time, live time). This accelerator duplicates the **Clear Spectrum** Toolbar button, the **Clear** command on the right-mouse-button menu, and **Acquire**/**Clear**, discussed in Section 5.2.5.

9.3.4. Copy to Buffer <Alt + 5>

<Alt + 5> copies the histogram data from the selected Detector to the buffer, along with its descriptors (e.g., live time, real time), and displays the spectrum in a new window. This duplicates the **Copy to Buffer** command on the right-mouse-button menu and **Acquire**/**Copy to Buffer** (Section 5.2.6).

9.3.5. Detector/Buffer <Alt + 6>

<Alt + 6> switches the display between the histogram of the spectrum in the selected Detector and the spectrum in the buffer. The buffer will have the memory size of the spectrum that was last transferred from Detector or disk
file.

The Detector list on the right side of the Toolbar indicates whether the buffer or a particular Detector is currently displayed, and the Status Sidebar shows the presets for the displayed data.

This duplicates **<F4>** and **Display**/**Detector**/**Buffer**; see Section 4.6.2.

9.3.6. Narrower/Wider <+>/<–>

The <+> key increases the horizontal scale of the Expanded Spectrum View so the peaks appear wider, while the <–> key decreases the horizontal scale, making the peaks look narrower. The horizontal and vertical scale values are displayed on the Toolbar. These functions are duplicated by **<F7>**/**<F8>**.

9.4. Function Keys

9.4.1. ROI <F2>

The **<F2>** key switches the ROI marker status among the **Mark**, **UnMark**, and **Off** conditions, so you can use the marker to set or clear the ROI bits for particular channels or groups of channels, or return the marker to normal usage. The current ROI marking status (**Marking**, **Unmarking**) is

shown in at the extreme right of the Menu Bar (**Off** mode is shown as blank). ROI bits are changed by using the keyboard to move the marker to a channel, as follows:

- **Mark** The channel is marked (set) as an ROI with the marker.
- **UnMark** The channel is removed from the ROI (reset) with the marker.
- **Off** The ROI status is unchanged with the marker.

9.4.2. ZDT/Normal <F3>

For the DSPEC Plus in ZDT mode, the **<F3>** key switches between the normal (LTC) or uncertainty (ERR) spectrum and the ZDT corrected spectrum. It duplicates the **Acquire/ZDT Display Select** command.

9.4.3. ZDT Compare <Shift+F3>

For instruments that support ZDT, in Compare mode, this accelerator switches the compare spectrum between the ZDT spectrum and its accompanying LTC or ERR spectrum. Used in combination with **<F3>** or **Acquire/ZDT Display Select**, it allows you to display the normal-to-ZDT, uncertainty-to-ZDT, ZDT-to-normal, or ZDT-to-uncertainty comparisons.

9.4.4. Detector/Buffer <F4>

The **<F4>** key switches between the display of the data in the Detector and the data in the buffer. It duplicates the function of **<Alt + 6>** and **Display/Detector/Buffer**; see Section 9.3.5.

9.4.5. Taller/Shorter <F5>/<F6>

These keys decrease or increase the vertical full scale of the displayed spectrum so the peaks appear taller or shorter, respectively. They duplicate the function of the <↑> and <↓> keys. The vertical scale value is always shown on the Toolbar.

9.4.6. Narrower/Wider <F7>/<F8>

These keys increase or decrease the horizontal scale of the data display so the peaks appear narrower or wider, respectively. They duplicate the function of <–> and <+> keys. The horizontal scale value is always shown on the Toolbar.

9.4.7. Select Detector <Ctrl + F1> through <Ctrl + F12>

These keys display the spectrum for the specified Detector **n** (where **n** = 1 to 12, corresponding to **<Ctrl+ Fn>**, in the order that the Detectors are defined in the Detector pick list; see Section 5.9.1). The selected Detector name (or the buffer) is shown on the Toolbar.

These keys duplicate the function of the Detector pick list on the Toolbar, and the **Detector...** dialog under the **Display** menu. However, you should be aware of which Detector numbers are available when using the function keys. An error message box will appear if the selected Detector is invalid. In systems with more than 12 Detectors, use **Display/Detector...** or the drop-down list on the Toolbar.

9.5. Keypad Keys

9.5.1. Log/Linear — Keypad</>

Keypad</> toggles the active spectrum window between logarithmic and linear vertical display. This is duplicated by the **Log** Toolbar button. The vertical scale can be controlled with the **Zoom In**/**Zoom Out** Toolbar buttons, **Keypad**<+>/<–>, the <↑> and <↓> keys, and <**F7**/**F8**>.

9.5.2. Auto/Manual — Keypad<*>

Keypad<***>** switches the spectrum window between automatic and manual vertical full scale (see the discussion in Section 5.9.6). This is duplicated by the **Vertical Auto Scale** button on the Toolbar.

9.5.3. Center — Keypad<5>

Keypad<**5**> forces the marker to the center of the screen by shifting the spectrum without moving the marker from its current channel. This is duplicated by the **Center** button on the Toolbar. For more information, see Section 5.9.8.

9.5.4. Zoom In/Zoom Out — Keypad<+>/<–>

Keypad<+> increases the scale of both axes in the Expanded Spectrum View so the peaks appear larger, while **Keypad**<–> does the opposite, making the peaks look smaller. The scale value for both axes is always shown on the Toolbar. These functions are duplicated by the **Zoom In**/**Zoom Out** Toolbar buttons.

9.5.5. Fine Gain — Keypad<Alt + +>/<Alt + –>

These accelerators step the internal amplifier up or down by one increment of fine gain on the selected Detector, if it has a software-controlled amplifier. The new fine gain setting is shown on the Supplemental Information Line at the bottom of the screen. If the gain stabilizer is active, the display of the histogram data might not change.

The fine gain can also be set with **Acquire**/**Adjust Controls...** (Section ?) and **Keypad**<**Shift** + **Alt** + +>/ <**Shift** + **Alt** + –>; and keyboard <**Alt** + +>/<**Alt** + –> and <**Shift** + **Alt** + +>/<**Shift** + **Alt** + –>.

10. JOB FILES

The ScintiVision `.JOB` file consists of one or more lines of ASCII text representing a series of commands that can automate most of the functions described earlier in this manual. The details of the commands and the required syntax are given in this chapter. To create a new `.JOB` file, use Windows Notepad or another ASCII editor; or open an existing `.JOB` file from **Services**/ **Job Control...**, edit it, and save it under a new name. A `.JOB` file can be started from the **Job Control...** dialog, or by including the name of the `.JOB` file (e.g., `GVDEMO.JOB`) on the command line when ScintiVision is first started (see Section A.1.1).

`.JOB` files are used for the following types of functions:

- Performing a repetitive task, such as running a sequence of experiments without user intervention.

- Defining initial conditions at startup (useful in preloading presets after a power loss for the 916/916A/917/918/918A each time ScintiVision is run).

`.JOB` files written for previous versions of ScintiVision or MAESTRO can be used. The text versions of these files will work on new Detectors as well as older models, with the exception of new commands and deleted commands.

ScintiVision can run repetitive loops. Furthermore, the current loop count can be included as a variable in any string, including filenames, program parameters, and text. Data can thus be stored with unique filenames and labeled with unique descriptions.

If an error is encountered in running a `.JOB` file, the execution of the file stops and control returns to ScintiVision. An error code appears in the **JOB Control...**. dialog box; these are described in Appendix C.

In addition, if the appropriate **Ask on Start** or **Ask on Save** fields are checked in the **Acquire** or **File** settings dialog boxes, these questions will be asked when START or SAVE commands are executed in the `.JOB` file. This means that execution of the `.JOB` file will stop until the entry is made.

The ASK commands will also stop the `.JOB` file and prompt you to enter the requested information. The `.JOB` file will continue when you click on **OK** or press **<Enter>** on the dialog. The input is used or stored immediately, before the next JOB instruction, except for the ASK_SPECTRUM command.

When `.JOB` files are used with locked Detectors, the first time a destructive command is used on the locked Detector, you are prompted for the password. From that point, while the `.JOB` file is

running, the password is retained and you are not prompted. When the `.JOB` file quits, the password is forgotten.

In the following descriptions, a variable filename or text is enclosed in "**...**" and a variable number is enclosed in <**...**>; anything enclosed in square brackets [**...**] is optional.

10.1. Summary of JOB Commands

This section provides a quick reference to the JOB commands; for more detailed information, see Section 10.4.

ANALYZE ["spectrum filename"]
Analyzes the spectrum in the same manner as the menu commands.

ASK_CALIBRATION
Asks for the internal calibration filename, then reads the file and loads the calibration.

ASK_COLLECTION
Asks for the date and time for the decay correction.

ASK_CONFIRM ["text"]
This displays "text" and waits for the user to click on **OK**.

ASK_DESCRIPTION
Asks for sample description.

ASK_LIBRARY
Asks for the name of the internal library, then loads it.

ASK_OPERATOR
Asks for the user's name.

ASK_OPTIONS
Asks for the Sample Description Filename of the analysis options.

ASK_PASSWORD
Asks for password (used to lock Detectors).

ASK_ PBC
Asks for the name of the Peak Background Correction file, then loads it.

ASK_PRESET
Asks for the presets to be set in the detector.

ASK_SPECTRUM
Asks for the spectrum filename to be used in following SAVE commands.

ASK_WEIGHT
Asks for the sample size and units.

BEEP <freq>,<duration>
Produces an audible sound of <freq> Hz, lasting <duration> milliseconds.

BEEP ID
A numerical ID is given based on a desired system event.

BEEP "String"
String can be a **.WAV** file or any event defined in the Registry.

CALIBRATE_AUTO
This command executes the automatic energy calibration.

CALIBRATE_EFFICIENCY "file.eft"
Performs an efficiency calibration using the active spectrum and the data in file.eft.

CALIBRATE_ENERGY "file.ent"
Performs an energy calibration using the active spectrum and the data in file.ent.

CALL "file.job"
Executes another **.JOB** file as a subroutine.

CHANGE_SAMPLE
Provides sample changer hardware handshake.

CLEAR
Clears the data and descriptors in the active Detector.

DESCRIBE_SAMPLE "text"
Enters the text into the sample description to be saved with the spectrum.

END_LOOP — see **LOOP**

EXPORT "filename"
This command executes the Export function with the filename specified.

FILL_BUFFER
Transfers the data from the active Detector to the buffer.

IMPORT "filename"
This command executes the Import function with the filename specified.

LOAD_LIBRARY "lib.mcb"
Loads a nuclide library.

LOAD_PBC "file.pbc"
Loads a PBC file.

LOCK "Pwd" [,"Name"]
This command locks the current Detector using "Pwd" as the password. If the optional "Name" parameter is missing, the Locked name defaults to "Job".

LOOP <reps>...**END_LOOP**
Executes all the commands between LOOP and END_LOOP, <reps> number of times.

LOOP SPECTRA...END_LOOP
This command executes the commands within the loop once for each spectrum stored in the Detector hardware.

MARK_PEAKS
Sets ROIs on all peaks in the buffer.

QABACKGROUND
This command executes the background QA test without displaying prompts or violations.

QASAMPLE
This command executes the sample QA test without displaying prompts or violations.

QUIT
Terminates this copy of ScintiVision.

RECALL "file"
Reads the spectrum data file into the buffer.

RECALL_CALIB "file"
Loads both the energy and efficiency calibration data from the disk file to the selected memory calibration parameters. The spectrum is not changed.

RECALL_EFFICIENCY "file"
Loads the efficiency calibration data from the disk file to the selected memory calibration parameters. The spectrum is not changed.

RECALL_ENERGY "file"
Loads the energy calibration data from the disk file to the selected memory calibration parameters. The spectrum is not changed.

RECALL_OPTIONS "file.svd"
Sets the analysis options from the table in the file.

RECALL_ROI "file.roi"
Sets the ROIs from the table in the file.

REM [Text]
This line is a comment (remark) and is ignored during command processing.

REPORT "filename"
Writes the ROI-marked peak report (not the analysis report) to the disk filename or to the printer (PRN:).

RUN "program"
Executes a Windows application program or non-Windows application. See your Microsoft documentation for more details.

RUN_MINIMIZED "program"
Same as the **RUN** command above, except that the application is run initially as an icon (minimized), rather than as a normal window.

SAVE "file.chn" [,n]
Saves the current spectrum to disk in the format specified in the **File/Settings** menu.

SAVE_CALIBRATION "file.CLS"
Saves the current energy, efficiency, and TCC calibrations to the specified `.CLS` file.

SAVE_ROI "file.roi"
Saves the table of ROIs in the display to the specified disk file.

SEND_MESSAGE "text"
Sends the text as a command to the Detector.

SET_BUFFER
Selects the buffer, same as SET_DETECTOR 0.

SET_DETECTOR <number>
Selects the Detector or buffer (0).

SET_NAME_STRIP "file.chn"
Sets the strip file. See STRIP below.

SET_PRESET_CLEAR
Clears all presets in active spectrum.

SET_PRESET_COUNT <n>
Sets the ROI Count preset to <n> counts.

SET_PRESET_INTEG <n>
Sets the ROI Integral preset to <n> counts.

SET_PRESET_LIVE <t>
Sets the live-time preset to <t> seconds.

SET_PRESET_REAL <t>
Sets the real-time preset to <t> seconds.

SET_PRESET_UNCERTAINTY <limit>,<low chan>,<high chan>
Sets the statistical preset to the uncertainty based on the counts in the region between the low and high channels. (Not valid on all MCBs.)

SMOOTH
Smooths the spectrum in the buffer.

START
Starts the selected Detector.

START_OPTIMIZE
Starts the optimize function for the Detector (for DSPEC only).

START_PZ
Starts the PZ function for the Detector. It is automatically included in the optimize function.

STOP
Stops the selected Detector.

STOP_PZ
Stops the PZ function for the detector.

STRIP <factor>,[“file”]
Strips a spectrum file from the buffer.

UNLOCK “Pwd”
This command unlocks the current Detector using “Pwd” as the password.

VIEW “i”
This command moves the “i”th stored spectrum to position 0.

WAIT [<seconds>]
Waits a fixed number of seconds or until the active detector stops counting (if no seconds specified).

WAIT “program”
Waits until the named program, e.g., started by the RUN command, stops execution.

WAIT_AUTO
Waits until the optimize function is complete (for DSPEC only).

WAIT_CHANGER
Waits until the sample ready signal on the rear panel is present.

WAIT_PZ
Waits until the PZ function is complete.

WAIT_QA
This command waits until QA is complete.

WAIT_SERIAL
This command is used to control serial devices such as sample changers.

ZOOM <i>
Changes the size of the ScintiVision window to icon, normal, or maximum.

ZOOM: <x,y,w,h>
Changes the position and size of the ScintiVision window to the stated values.

10.2. .JOB File Variables

Variables have been added to the **.JOB** file features to allow more flexibility and control of the JOBS. These variables are defined by the program or by user entries. They can be used anywhere in the **.JOB** file.

For example:

```
$(FullPath)= D:\USER\SOIL\SAM001.SPC
```

then:

```
$(FullBase)     =  D:\USER\SOIL\SAM001
$(FileExt)      =  SPC
$(FileDir)      =  D:\USER\SOIL
$(ShortPath)    =  SAM001.SPC
$(ShortBase)    =  SAM001
```

The following variables are expanded in **.JOB** file strings:

$(FullPath)	Full pathname of the spectrum file
$(FullBase)	Full pathname of the spectrum without the “.” and extension
$(FileExt)	File extension of the spectrum file without the “.”
$(FileDir)	Directory of the spectrum file without the last backslash (\)
$(McaDir)	ScintiVision directory without the last backslash
$(CurDir)	Starting (current) directory of ScintiVision
$(Loop)	Current value of the loop counter (zero based)
$(Loop1)	Loop counter plus 1
$(Bel)	ASCII bell character
$(CR)	ASCII carriage return character
$(FF)	ASCII form feed character
$(LF)	ASCII line feed character
$(ESC)	ASCII escape character
$(AutoFile)	Create an automatic filename based on the **Start**/**Save**/**Report** settings
$(ShortPath)	Relative pathname of the spectrum file

$(ShortBase)	Relative pathname of the spectrum without the "." and extension
$(Password)	Value entered in ASK_PASSWORD command
$(Owner)	Value entered in ASK_PASSWORD command

The filename variables are updated each time a READ operation is performed. The READ operations are:

ANALYZE "file"	LOAD
ASK_CALIBRATION	RECALL
ASK_LIBRARY	RECALL_CALIBRATION
ASK_OPTIONS	RECALL_EFFICIENCY
ASK_PBC	RECALL_ENERGY
ASK_SPECTRUM	RECALL_OPTIONS
CALIBRATE_EFFICIENCY	RECALL_ROI
CALIBRATE_ENERGY	STRIP

The filename is not updated for WRITE commands.

The following sample **.JOB** file will produce a set of files in which the last character of the filename is a digit that increments with each loop.

```
ASK_SPECTRUM
LOOP 5
SAVE "$(FULLBASE)$(LOOP1).$(FILEEXT)"
END_LOOP
```

10.3. JOB Programming Example

A common operation that is ideal for a **.JOB** file is the collection of many consecutive sample spectra without user intervention. An example of this is the collection of a series of spectra to show the radioactive decay in a particular sample.

This process can be described as follows:

1. Set the Detector parameters, such as live time.
2. Start the acquisition.
3. Wait for the acquisition to stop.
4. Integrate the nuclide peak.
5. Record the peak area.
6. Repeat this for the required number of samples.

By looking at the list of steps above and the explanations below, the necessary commands can be determined and written down.

The first step in the process is to initialize the Detector to the condition needed of 1000 seconds live time. These are:

```
SET_DETECTOR 1
SET_PRESET_CLEAR
SET_PRESET_LIVE 1000
CLEAR
```

Note that all the presets were cleared before setting the live-time preset. This is to ensure that no previous presets (left over from other users) will interfere with this analysis.

Now start the acquisition and wait for completion of the live time.

```
START
WAIT 2
WAIT
```

During this time the display manipulation keys are active so that the spectrum can be studied while collection is taking place.

"**WAIT 2**" is necessary to ensure that the acquisition has started before the wait command is reached. It is also necessary to add **WAIT 2** after the ANALYZE and RUN commands.

Now move the spectrum from the Detector to the buffer. Select the buffer for the computational step.

```
FILL_BUFFER
SET_DETECTOR 0
```

In this step, the nuclide peak of interest is being marked by reading in an **.ROI** file. This **.ROI** file has been previously defined by looking at the spectrum and marking the peak (or the region around the peak). This ROI data is saved on the disk under the name **DECAYPK.ROI**. This **.JOB** file will work on different peaks or nuclides just by changing the **.ROI** file.

```
RECALL_ROI "DECAYPK.ROI"
```

The peak areas of the marked peak or peaks is printed on the printer by this command.

```
REPORT "PRN"
```

This gives a list of the peak areas and count rates for the marked peak. If the library (**LIB.MCB**) has a peak near this energy then the peak identity will also be printed.

The set of instructions, as written so far, will only collect and report once. There are two ways to make the process repeat itself for a series of samples. The first and hardest is to write one set of the above instructions for every sample in the series. A much more efficient way is to use the LOOP command. To use this, put LOOP before CLEAR and END_LOOP after REPORT. The whole **.JOB** file now looks like this:

```
SET_DETECTOR 1
SET_PRESET_CLEAR
SET_PRESET_LIVE 1000
LOOP 10
CLEAR
START
WAIT 2
WAIT
FILL_BUFFER
SET_DETECTOR 0
RECALL_ROI "DECAYPK.ROI"
REPORT "PRN"
SET_DETECTOR 1
END_LOOP
```

Note that an additional SET_DETECTOR 1 has been inserted after REPORT, *so the loop will operate on the desired Detector*.

Now select **Services**/**Job Control**. Click once on an existing **.JOB** filename then click the **Edit File** button. This will display the contents of that file in Windows Notepad. You can then *overwrite* the existing instructions with the above set of commands. However, save the new instructions to a new file named **SAMPDATA.JOB** using the **File**/**Save As** function (do not use **Save** or the original file will be lost).

This new **.JOB** file can then be executed in ScintiVision from the **Services** menu by selecting **Job Control...** to display the **Run JOB File** dialog. Select **SAMPDATA.JOB** from the list of files and click on **Open**.

10.3.1. Improving the JOB

This **.JOB** file can be improved by adding a save step for each spectrum collected. This is done by inserting the SAVE command in the **.JOB** file. The spectrum sample description is also entered here. This sample description is saved with the spectrum and is printed by the REPORT command. Note that the loop counter (the ??? in the **.JOB** file text) is used in the SAVE and DESCRIBE_SAMPLE commands.

The new **.JOB** file is:

```
SET_DETECTOR 1
SET_PRESET_CLEAR
SET_PRESET_LIVE 1000
LOOP 10
CLEAR
START
WAIT 2
WAIT
FILL_BUFFER
SET_DETECTOR 0
DESCRIBE_SAMPLE "This is sample ???."
SAVE "DECAY???.CHN"
RECALL_ROI "DECAYPK.ROI"
REPORT "PRN"
SET_DETECTOR 1
END_LOOP
```

Spooling the report could take some time. To overlap the data collection with the analysis, the logic of the **.JOB** file needs to be modified to restart the acquisition after the data have been moved to the buffer. All of the analysis is performed on the buffer spectrum so the Detector spectrum can be erased and the next one started.

Insert CLEAR and START after FILL_BUFFER, as shown here:

```
SET_DETECTOR 1
SET_PRESET_CLEAR
SET_PRESET_LIVE 1000
CLEAR
START
LOOP 10
WAIT
FILL_BUFFER
CLEAR
START
SET_DETECTOR 0
DESCRIBE_SAMPLE "This is sample ???"
SAVE "DECAY???.CHN"
RECALL_ROI "DECAYPK.ROI"
REPORT "PRN"
SET_DETECTOR 1
END_LOOP
```

These few examples have shown some of the possibilities of the JOB language in ScintiVision.

10.4. JOB Command Details

ANALYZE ["spectrum filename"]

This analyzes the spectrum in the same manner as the menu commands. With no argument, the spectrum in the display (either the MCB or the buffer) is analyzed according to the settings in the **Analyze/Settings/ Sample Type...** dialog. With a spectrum filename as argument, thespectrum on disk is analyzed according to the settings in the spectrum file. The filename can include any of the variables shown in Section 10.2.

To change the settings used in an analysis, load the spectrum into the buffer using the RECALL command, recall the new settings using the RECALL_SETTINGS command, then ANALYZE the spectrum in memory (no filename).

The complete entry is passed to WAN32 as the command line, so any of the command line options of WAN32 can be used.

The **.JOB** file does not wait until the analysis is complete before proceeding to the next command, however the results will be automatically output according to the settings (printed, file or program) when the analysis is complete. To force the JOB to wait until the analysis is complete, put a WAIT 2, then a WAIT "**WAN32.EXE**" command after the ANALYZE command.

The JOB command might exit after the ANALYZE command, but the QUIT command should not be used, as the results will not be printed if ScintiVision is not running.

ASK_CALIBRATION

This asks for the name of a file containing the calibration to be used as the internal calibration. After entering the filename, the file is read and the calibration is loaded.

ASK_COLLECTION

This asks for the date and time for the decay correction. It is the same as the date and time entry in the **Acquire/Acquisition Settings...** dialog. If any **Ask on Start** options are checked, the START command in the **.JOB** file will also open this dialog.

ASK_CONFIRM <"text">

This opens a dialog showing the text, and waits until you click on **OK**.

ASK_DESCRIPTION

This asks for the sample description to be put in the spectrum file and on the report. It is the same as the sample description entry in the **Acquire/Acquisition Settings...** dialog and the sample description entry in the **File/Settings...** menu. If the **Ask on Start** option is checked,

the START command in the **.JOB** file will also open this dialog. If the **Ask on Start** option is checked, the SAVE command in the **.JOB** file will also open this dialog.

ASK_LIBRARY

This asks for the name of the library to be used as the internal library. After entering the filename, the library file is loaded.

ASK_OPERATOR

This asks for the operator's name to be put in the spectrum file and on the report. It is also stored in the Registry.

ASK_OPTIONS

This asks for the **.SVD** (sample defaults file) filename of the analysis options. The **.SVD** file is created in the **Analyze/Settings/Sample Type...** dialog. It is the same as the sample type entry in the **Acquire/Acquisition Settings...** dialog. If **Ask on Start** is checked, the START command in the **.JOB** file will also open this dialog.

ASK_PASSWORD

This is used to define the password to be used in the **.JOB** file. This command can be to lock an unlocked detector, unlock and use one that is locked, or lock one for the duration of the job and then unlock it. The actual lock/unlock is done with LOCK and UNLOCK, respectively.

This command is to set the internal password variable, **$(PASSWORD)**, to the user input so the password will be available for use in the JOB. The **$(OWNER)** variable is only used when locking detectors. Following is an example:

```
.
.
.
ASK_PASSWORD
LOCK "Pwd","Name"
.
.
.
```

ASK_PBC

This asks for the name of the peak background correction to be used. After entering the filename, the Peak Background Correction file is loaded.

ASK_PRESET

This asks for the presets to be set in the Detector. It is the same as the preset entry in the **Acquire/Acquisition Settings...** dialog. If **Ask on Start** is checked, the START command in the **.JOB** file will also open this dialog.

ASK_SPECTRUM

This asks for the spectrum filename to be used in the next and subsequent **SAVE** commands. See **SAVE** command below. This is stored in the variables **`$(FullPath)`**, **`$(FullBase)`**, **`$(FileExt)`**, and **`$(FileDir)`**.

ASK_WEIGHT

This asks for the sample size and units to be stored in the spectrum file and used in the analysis. It is the same as the sample size entry in the **Acquire/Acquisition Settings...** dialog and the sample size entry in the **File/Settings...** menu. If **Ask on Start** is checked, the START command in the **`.JOB`** file will also open this dialog. If **Ask on Save** is checked, the SAVE command in the **`.JOB`** file will also open this dialog.

BEEP <freq>,<duration>

This produces an audible tone at a pitch of <freq> Hertz, lasting for <duration> milliseconds. For example, BEEP 1000,1000 is a suitably annoying alarm, while BEEP 50,50 is a short "burp."

This command is disabled by Windows if any "sound" software is used. It should be used with caution if other sound-producing software is running.

BEEP ID

A numerical ID is given based on a desired system event. For example, **BEEP** 7 will exit Windows.

ID	**Event**
0	Beep Speaker
1	Default Beep
2	Start Windows
3	Asterisk
4	Exclamation
5	Critical Stop
6	Question
7	Exit Windows

BEEP "String"

String can be a **`.WAV`** file or any event defined in the Registry.

CALIBRATE_EFFICIENCY "file.eft"

Performs an efficiency calibration using the active spectrum and the data in **`file.eft`**. The filename can include any of the variables defined in Section 10.2.

CALIBRATE_ENERGY "file.ent"

Performs an energy calibration using the active spectrum and the data in **`file.ent`**. The filename can include any of the variables defined in Section 10.2.

CALL "file.job"

Executes another **`.JOB`** file as a subroutine. The filename can include any of the variables defined in Section 10.2.

CHANGE_SAMPLE

This is used to control the CHANGE SAMPLE output and SAMPLE READY input BNC signals on the rear panel of most MCBs, and is intended to initiate a hardware handshake sequence for advancing a sample changer. The SET_OUTPUT_HIGH command is sent to the currently selected Detector, then the sample-ready status is monitored (for at least 120 seconds) until the input is low, then finally the SET_OUTPUT_LOW command is sent and input is monitored until it returns to the high level again before proceeding.

Note that if the sample changer controls are not able to make the SAMPLE READY input go high very soon after the CHANGE SAMPLE signal is set (i.e., the normal state of the SAMPLE READY is low; it is expected to go high immediately after the CHANGE SAMPLE condition is set and remain high while the sample changer is moving, and returns to low when the sample changer is at its new position), then it might be necessary to use the SEND_MESSAGE command to send a SET_OUTPUT_HIGH command, then pause (with WAIT or some other time-consuming command), and then send the CHANGE_SAMPLE command. The following example demonstrates this:

```
SET_DETECTOR 1
LOOP 5
CLEAR
START
WAIT
WAIT 2
FILL_BUFFER
SEND_MESSAGE "SET_OUTPUT_HIGH"
SET_DETECTOR 0
SAVE "MONTE???.CHN"
SET_DETECTOR 1
CHANGE_SAMPLE
END_LOOP
```

CLEAR

This clears (erases) the data, the real time and the live time for the selected Detector. The presets are not changed. This command has the same function as the CLEAR function under the ACQUIRE menu. The command would logically be preceded by the SET_DETECTOR commands as follows:

```
.
.
.
SET_DETECTOR 1
CLEAR
.
.
.
```

DESCRIBE_SAMPLE "description"

This accepts a 63-character description of the sample being analyzed. This description is saved with the spectrum using the SAVE command function, and is included in the REPORT printout. This performs the same function as the **Sample Description** function under the **Services** menu.

The loop count value can be included in any text by typing three question marks in the text where the loop count is to be inserted. The loop count replaces "???" with three characters wherever it appears.

END_LOOP — see **LOOP**

EXPORT "filename"

This executes the Export function with the filename specified. The remainder of the options are defined on the Export tab under **File/Settings...**. The filename can include any of the variables defined in Section 10.2.

FILL_BUFFER

This transfers the active Detector data to the buffer. This command has the same function as **Copy to Buffer** under **Acquire**.

IMPORT "filename"

This executes the Import function with the filename specified. The remainder of the options are defined on the Import tab under **File/Settings**. The filename can include any of the variables defined in Section 10.2.

LOAD_LIBRARY "name.lib"

This loads the nuclide library specified, and duplicates the function of **Select File** under the **Library** menu. The filename can include any of the variables defined in Section 10.2.

LOAD_PBC "name.pbc"

This loads the Peak Background Correction specified, and duplicates the function of **Select File** under the **Library** menu. The filename can include any of the variables defined in Section 10.2.

LOCK "Pwd" [,"Name"]

This locks the current Detector using "Pwd" as the password. If the optional "Name" parameter is missing, the Locked name defaults to "Job". This password is retained in the **.JOB** file and used with any **.JOB** commands so that the user does not need to re-enter the password.

LOOP <repetitions> **... END_LOOP**

This pair executes multiple times all the commands between LOOP and END_LOOP. The number of execution times is specified by <repetitions>. Each command must be given on a separate line. A value of 0 executes once. A LOOP with no END_LOOP statement executes once.

The loop count value can be included in any text by typing three question marks in the text where the loop count is to be inserted. The loop count replaces "???" with three characters using leading zeros if necessary.

The loop variables, **$(Loop)** and **$(LOOP1)**, can be included in any text. The loop count will be inserted with leading zeros suppressed.

The following is an example:

```
SET_DETECTOR 1
SET_PRESET_LIVE 20
LOOP 3
SET_DETECTOR 1
CLEAR
START
WAIT 2
WAIT
FILL_BUFFER
SET_DETECTOR 0
SAVE "TEST???.CHN"
END_LOOP
```

The above commands run three 20-second acquisitions and store the data on a disk in **TEST001.CHN**, **TEST002.CHN** and **TEST003.CHN**.

If the SAVE command is replaced with SAVE "**TEST$(Loop).CHN**," then the following files will be saved: **TEST0.CHN**, **TEST1.CHN**, and **TEST2.CHN**.

LOOP SPECTRA...END_LOOP

This executes the commands within the loop once for each spectrum stored in the Detector hardware. This command only works for hardware that supports Field Mode.

MARK_PEAKS

This does a Mariscotti-type peak search on the spectrum in the selected data memory. The peak search sensitivity is selected in the **Calculate** menu. Each peak found is marked with an ROI. If the selected data memory is calibrated, the width of the ROI is three times the calculated FWHM of the peak. If the selected data memory is not calibrated, the width of the ROI equals the width of the peak as determined by the peak search function. Overlapping or close peaks could have contiguous ROIs. Existing ROIs are not cleared. This command has the same function as **Peak Search** in the **Calculate** menu.

The following is an example of the MARK_PEAKS command used with REPORT:

```
.
.
.
MARK_PEAKS
REPORT "TESTDAT.RPT"
.
.
```

The above procedure does a peak-search-directed report of nuclides found.

QABACKGROUND

This executes the background QA test without displaying prompts or violations.

QASAMPLE

This executes the sample QA test without displaying prompts or violations.

QUIT

This unconditionally terminates the ScintiVision program and returns control to Windows.

RECALL “file.chn” or “file.spc”

This reads a disk filename to the buffer. The disk file must be in the format created by SAVE. Any DOS filename, including the drive and subdirectory, can be used. The resultant horizontal size of the buffer is the same as the file. If the spectrum file has calibration information, the calibration parameters in the spectrum file are used to set the calibration for the buffer.

This command has the same function as **Recall...** under the **File** menu.

The loop count value can be included in the above filename, as in any text, by typing three question marks in the text where the loop count is to be inserted. The loop count replaces "???" wherever they appear. The filename can include any of the variables defined in Section 10.2.

RECALL_CALIB "file "

This loads both the energy and efficiency calibration data from the specified file to the calibration data for the selected Detector. If the file is a pure calibration file (**.CLS**), then all the information, including any energy or efficiency tables, are replaced in the selected spectrum data memory. If the file is a spectrum data type file **.CHN**, only the calibration parameters from the calibration data stored with a spectrum are loaded.

The filename can include any of the variables defined in Section 10.2.

This command can be used in generating reports that include library nuclide identification. The following is an example:

```
.
.
.
RECALL_CALIB "CALIB001.CLS"
MARK_PEAKS
REPORT "NEWDATA.RPT"
.
.
.
```

The report **NEWDATA.RPT** includes nuclide identification using the energy calibration contained in **CALIB001.CLS.**

RECALL_EFFICIENCY "file "

This loads the efficiency calibration data from the specified file to the calibration data for the selected Detector. If the file is a pure calibration file (**.CLS**), then all the information, including any efficiency tables, are replaced in the selected spectrum data memory. The filename can include any of the variables defined in Section 10.2.

RECALL_ENERGY "file "

This loads the energy calibration data from the specified file to the calibration data for the selected Detector. If the file is a pure calibration file (**.CLS**), then all the information, including any energy tables, are replaced in the selected spectrum data memory. If the file is a spectrum data type file **.CHN**, only the calibration parameters from the calibration data stored with a spectrum are loaded. The filename can include any of the variables defined in Section 10.2.

RECALL_OPTIONS "file.svd"

This loads the acquisition and analysis parameters into the working set for the selected Detector or buffer. This is the same as recalling a **.SVD** file in the **Analyze/Settings/Sample Type...** type dialog. The filename can include any of the variables defined in Section 10.2.

RECALL_ROI "file.roi"

This marks the ROI channels in the selected data memory or Detector to conform to the table in the disk file, which can be an **.ROI**, **.UFO**, **.SPC**, or **.LIB** file. The data contents of the Detector or buffer are not altered by this operation. The previous ROIs are cleared. The filename can include any of the variables defined in Section 10.2.

This command has the same function as **Recall File**... under **ROI**.

This command can be used in generating reports that look for specific nuclides (library-directed as opposed to peak-search-directed). For example, a calibration spectrum is run containing ^{57}Co and ^{137}Cs, and ROIs marked on the 122-keV and 662-keV peaks.

The calibration is saved as spectrum file **COBCS.CHN** and as **.ROI** file **COBCS.ROI**. The command sequence is:

```
.
.
.
RECALL_CALIB "COBCS.CHN"
RECALL_ROI "COBCS.ROI"
REPORT "COBCS.RPT"
.
.
.
```

These commands report the values only for the 122-keV and 662-keV peaks. Compare with the example for MARK_PEAKS.

As usual, the loop count value can be included in any text by typing three question marks in the text where the loop count is to be inserted.

REM [Text]

This line is a comment (remark) and is ignored during command processing. The REM command allows entering descriptive comments into script files or disabling commands during testing of scripts.

REPORT "filename"

This prints the sample and detector descriptions, the Detector number, real time and live time, and the date of the selected data memory. The format of the report is described in the

discussion of the **File** menu for the **Report** function. This command has the same function as **Report** under **Analyze**.

The output can be printed on the printer (PRN), or sent to a disk file which can be used by other programs or printed later. The loop count value can be included in the filename by typing three question marks in the text where the loop count is to be inserted. The loop count replaces "???" in the filename. The filename can include any of the variables defined in Section 10.2.

RUN "program"

This executes an application named "program." This is typically an **.EXE** filename. Note that the program will not run to completion before returning to ScintiVision, unless it is run at higher priority or the WAIT command is used. The filename can include any of the variables defined in Section 10.2. Any arguments to the program can be included in the quotation marks.

RUN_MINIMIZED "program"

Same as the RUN command above, except that the application is run initially as an icon (minimized), rather than as a normal window.

SAVE "[d:][\path\]file[.spc]" [,n]

This saves the active Detector or the selected data memory in a disk file. It has the same function as **Save As...** under the **File** menu. The file type is determined in the **File/Settings...** dialog. The disk filename (in quotation marks) can be any valid DOS filename; the drive [d:], path [\path\] and extension [.spc] are optional. If an extension is not supplied, the default extension is automatically determined by the file settings selection. Also, the current drive and directory are used by default when the optional path specification is not supplied. The loop count value can be included in the filename by typing three question marks in the text where the loop count is to be inserted. The loop count replaces "???" wherever it appears. The filename can include any of the variables defined in Section 10.2.

The optional argument n specifies the spectrum number to save for a **.CHN** or **.SPE** file. For the DSPEC Plus in ZDT mode zero, a value of zero will switch the display to the normal spectrum before the data is saved and a value of 1 will switch the spectrum to the ZDT spectrum before the save. For the DSPEC Plus in ZDT mode one, a value of 1 will switch the display to the ZDT spectrum before the data is saved and a value of zero will switch the spectrum to the Error spectrum before the save. This parameter is ignored if the DSPEC Plus is not in ZDT mode. This parameter is not used when saving data to an **.SPC** file since both spectra are automatically saved.

The **Ask on Save** questions as defined in **File/Settings...** will be asked each time a SAVE command is executed. This will stop execution of the **.JOB** file until the question is answered.

As for the **Save As** function, the real time, live time, start of acquisition, and, if available, calibration data, detector description, and sample description are stored with the spectrum.

If the **ASK_SPECTRUM** command has been executed in this **.JOB** file prior to this SAVE command, the filename is stored in **$(FullPath)**.

SAVE_CALIBRATION "[d:][\path\]file[.CLS]"

This saves the current working energy and efficiency calibrations to a **.CLS** file. It has the same function as **Save Calibration...** under the **Calibrate** menu. The contents of the spectrum are not altered by this operation. The disk filename (in quotation marks) can be any valid filename, with optional elements as described for the SAVE command, above. The default extension is **.CLS**. The loop count value can be included in the filename by typing three question marks in the text where the loop count is to be inserted. The loop count replaces "???" wherever it appears. The filename can include any of the variables defined in Section 10.2.

SAVE_ROI "[d:][\path\]file[.roi]"

This saves a table of channel numbers that have the ROI set for the active Detector or selected data memory in a disk file. It has the same function as **Save File...** under the **ROI** menu. The contents of the spectrum are not altered by this operation. The disk filename (in quotation marks) can be any valid filename, with optional elements as described for the SAVE command, above. The default extension is **.ROI**. The loop count value can be included in the filename by typing three question marks in the text where the loop count is to be inserted. The loop count replaces "???" wherever it appears. The filename can include any of the variables defined in Section 10.2.

SEND_MESSAGE "command"

This is used to send NIM-488 commands to the active Detector. This can be used to perform any operations of the Detector that are desired. The text must be in the syntax expected by the Detector. If the response from the Detector does not end with a command-accepted message, then this command will exit with error.

Specific Detector commands and syntax are described in the technical manual associated with each specific Detector.

The following is an example of using this command to set the fine and coarse gain to a total value of 50 (the product of the fine [= 0.5] and coarse [= 100] gains):

```
.
.
.
SET_DETECTOR 1
STOP
CLEAR
SEND_MESSAGE "SET_GAIN_FINE 2048"
SEND_MESSAGE "SET_GAIN_COARSE 100"
.
.
.
```

SET_BUFFER

This selects the buffer. It is the same as SET_DETECTOR 0.

SET_DETECTOR <number>

This selects the active Detector or the buffer. The Detector number can be 1 to 999 according to the Detector configuration, or 0 for the buffer. Also, SET_DETECTOR without an argument is used to switch to the previously selected Detector. If a Detector is selected that does not exist, no change is made. The Detector number is the number shown on the Toolbar and the Detector pick list.

This command (for values 1 to 12) has the same function as **<Ctrl+ F1>** through **<Ctrl+ F12>**. For value 0 or no argument at all, it duplicates the **Detector/Buffer** toggle under the **Display** menu, **<F4>**, and **<Alt+ 6>**.

SET_NAME_STRIP "file.chn"

This can be used before STRIP to select a disk filename to be used subsequently by the STRIP command. (It is not necessary to use this command, because the filename can be supplied as part of the STRIP command itself; however, the command is included for backward compatibility with MAESTRO II command files.) No other action is taken by this command. The filename can include any of the variables defined in Section 10.2.

SET_PRESET_CLEAR

This clears the presets for the active Detector. The clearing should be done to ensure that unwanted presets are not used by the Detector when the Detector is started.

NOTE For the Models 916/17/18 Detectors, the new presets (including CLEAR) can be loaded at any time, but are not put into effect until the Detector goes from STOP to START. For most other MCBs, the presets can only be changed when the unit is not counting.

The Detector should be selected by the SET_DETECTOR commands before the SET_PRESET_CLEAR command is given, as in the following:

```
.
.
.
SET_DETECTOR 1
STOP
SET_PRESET_CLEAR
START
.
.
.
```

SET_PRESET_COUNT <counts>

This sets the ROI peak count preset for the active Detector. The preset is set to the entered value. With this preset condition, the Detector stops counting when any ROI channel's content reaches this value. If no ROIs are marked in the Detector, then that Detector never meets this condition. This command has the same function as the **ROI Peak Count** field on the Presets tab under **Acquire/MCB Properties...** (Section ?); refer to the discussion describing that dialog for additional information.

SET_PRESET_INTEGRAL <counts>

This sets the ROI Integral Count preset value for the active Detector. The preset is set to the entered value. With this preset condition, the Detector stops counting when the sum of all counts in all channels marked with an ROI reaches this limit. If no ROIs are marked in the Detector, then that Detector never meets this condition. This command has the same function as the **ROI Integral** field on the Presets tab under **Acquire/MCB Properties...** (Section ?); refer to the discussion describing that dialog for additional information.

SET_PRESET_LIVE <seconds>

This sets the live-time preset for the active Detector. The preset is set to the entered value. With this condition, the Detector stops counting when the live time reaches this limit. The live time is the real time minus the dead time. This command has the same function as the **Live Time** field on the Presets tab under **Acquire/MCB Properties...** (Section ?); refer to the discussion describing that dialog for additional information.

SET_PRESET_REAL <seconds>

This sets the real-time preset for the active Detector. The preset is set to the entered value. With this preset condition, the Detector stops counting when the real time reaches this limit. This command has the same function as the **Real Time** field on the Presets tab under **Acquire/MCB Properties...** (Section ?); refer to the discussion describing that dialog for additional information.

SET_PRESET_UNCERTAINTY <limit>,<low chan>,<high chan>

This sets the statistical preset to the uncertainty based on the counts in the region between the low and high channels. This is only available in some MCBs (e.g., DSPEC, 92X-II). See Section 4.2.1.1 for details on the calculation. The low channel must be greater than 1 and the high channel must be greater than the low channel plus 7.

SMOOTH

This smooths the data in the buffer; its function is the same as **Smooth** under the **Calculate** menu. A five-point, area-preserving, binomial smoothing algorithm is used. The original contents of the buffer are lost.

START

This initiates data collection in the selected Detector. This function is the same as **Start** under the **Acquire** menu.

The **Ask on Start** questions as defined in **Acquire/Acquisition Settings...** will be asked each time a START command is executed. This will stop execution of the `.JOB` file until the question is answered.

START_OPTIMIZE

For DSPEC-series instruments that support the Optimize feature, this starts the optimize function for the Detector.

START_PZ

This starts the PZ function for the detector. It is automatically included in the optimize function. This command is only available for MCBs with internal amplifiers.

STOP

This stops data collection in the active Detector. If the Detector has already been stopped, no operation occurs. This command has the same function as **Stop** under the **Acquire** menu.

STOP_PZ

This stops the PZ function for the detector. Note that the PZ function is not complete when this is used. The PZ function should be allowed to complete automatically. This command is only available for MCBs with internal amplifiers.

STRIP <factor>,[“file.chn”]

This strips the disk spectrum specified in the SET_NAME_STRIP command or in the command itself (either way is acceptable; the filename is optional in this command) from the spectrum in the buffer and stores the results in the buffer. The disk and selected data memory spectra must be the same size. The disk spectrum can be scaled up or down by <factor> (a constant) or, if <factor> is zero, by the ratio of the live times of the two spectra. The filename can include any of the variables defined in Section 10.2.

UNLOCK “Pwd”

This unlocks the current Detector using “Pwd” as the password.

VIEW “i”

This moves the “i”th stored spectrum to position 0. This command is only valid in MCBs with Field Mode.

WAIT [<seconds>]

This suspends execution of the JOB to wait until either the active Detector stops counting (in the case where the <seconds> argument is not included), or for a fixed number of seconds.

WAIT “program”

This suspends execution of the JOB to wait until the named program stops execution. If the program does not stop, this JOB will not continue. It is good practice to put a WAIT 2 command between the RUN “program” and WAIT “program” commands to give Windows time to start the program before the status is checked. The “program” name must agree with the name used in Windows, and must include the **`.EXE`** extension.

WAIT_AUTO

For DSPEC only; this waits until the optimize function is complete.

WAIT_CHANGER

This waits until the sample ready signal on the rear panel is present. It is used in conjunction with the SEND_COMMAND function for more control over the sample changer than is provided by the CHANGE_SAMPLE command.

WAIT_PZ

This waits until the PZ function is complete.

WAIT_QA

This waits until QA is complete.

WAIT_SERIAL "Command", timeout[,"Response"]

This is used to send and receive commands on the serial port of MCBs. It is designed to be used to control sample changers with RS-232 controls. "Command" are the characters sent to the changer to make it operate. Timeout is the maximum time to wait for a response before error. "Response" is the reply from the changer when it has finished the "Command."

The first operation is to send "Command" out the serial port for the selected Detector. It then waits for a response or timeout according to these entries:

1. If a response string is provided, the length of the response string determines the exact number of characters to wait for.
2. If a response string is not provided, any character input will generate a success.
3. If a response string is provided, and the characters do not match, an Invalid Response message is generated and the JOB terminates.
4. If a timeout occurs, a Timeout Message is generated and the JOB terminates.

Example:

```
SET_DETECTOR 1
LOOP 3
   WAIT_SERIAL "$(Loop1)L$(CR)", 300, "$(BEL)"
   BEEP 5
END_LOOP
```

This code does the following:

1. Sends **1L↵** and waits 5 minutes for an ASCII Bell Character. Beeps 5 after ASCII bell is received.
2. Sends **2L↵** and waits 5 minutes for an ASCII Bell Character. Beeps 5 on success.
3. Sends **3L↵** and waits 5 minutes for an ASCII Bell Character. Beeps 5 on success.

The ↵ is the **`$(CR)`** (carriage return) character.

ZOOM <i>

Changes the size of the ScintiVision window. Selects one of icon, normal, or maximum according to the argument. The arguments are:

−1 = minimize (icon)
0 = normal (size determined by last use)
+1 = maximize (full screen)

ZOOM: <x,y,w,h>

Changes the position and size of the ScintiVision window. The arguments are:

x	=	x position of upper-left corner of window (0 is left)
y	=	y position of upper-left corner of window (0 is top)
w	=	width of window in pixels, starting at x and going right
h	=	height in pixels, starting at y and going down

Since these arguments are in pixels, experimentation is the best way to determine the desired size.

11. UTILITIES

11.1. WINPLOTS

This program makes a hardcopy output of any type of ORTEC spectrum file in a fixed format with many user-set optional variations (such as grid lines) available. The plotting output devices include the full range of graphics-capable printing devices supported by Windows (i.e., hardcopy is not limited only to plotters). WINPLOTS allows you to select and set up the printer. In the interactive mode, a preview of the spectrum plot is automatically displayed on the screen and updated as changes are made to the display parameters. You can select the start and stop channels or energy range for the plot, the printer to be used, whether the plot will be in logarithm mode or linear mode, and whether to specify the scale maximum in linear mode or use automatic scaling. If a color printer is used, the colors of the different parts of the plot can be selected.

The sample, detector, and acquisition descriptions in the file can be plotted or suppressed. ROIs can be plotted when stored in the spectrum (`.SPC`) file or in a separate ROI file.

To start WINPLOTS, go to the Windows **Start** menu and click on **ScintiVision 32**, **WinPlots** (see Fig. 215). WINPLOTS can also be run in command-line mode for use in `.JOB` files, or directly from other Windows programs (see Section 11.1.3). In this mode, the settings can be specified or the defaults can be used.

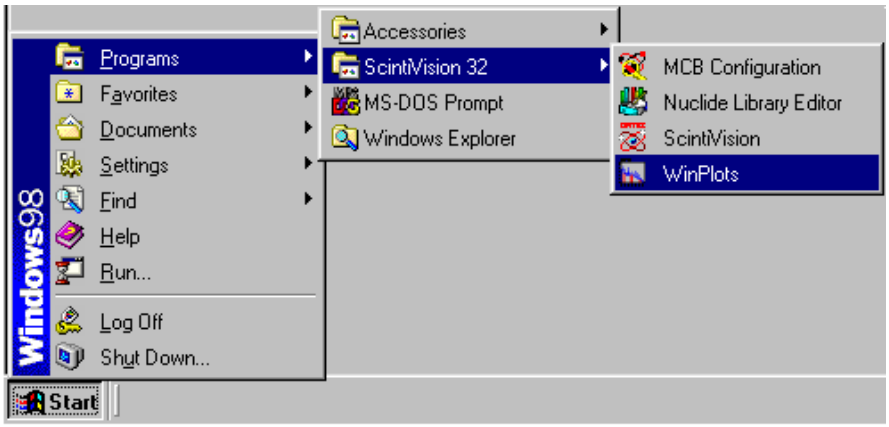


Fig. 215. Starting WINPLOTS.

The spectrum files are associated with WINPLOTS by the installation program, so double-clicking on a spectrum filename within Windows Explorer will start WINPLOTS and display that spectrum.

The main WINPLOTS display is shown in Fig. 216.

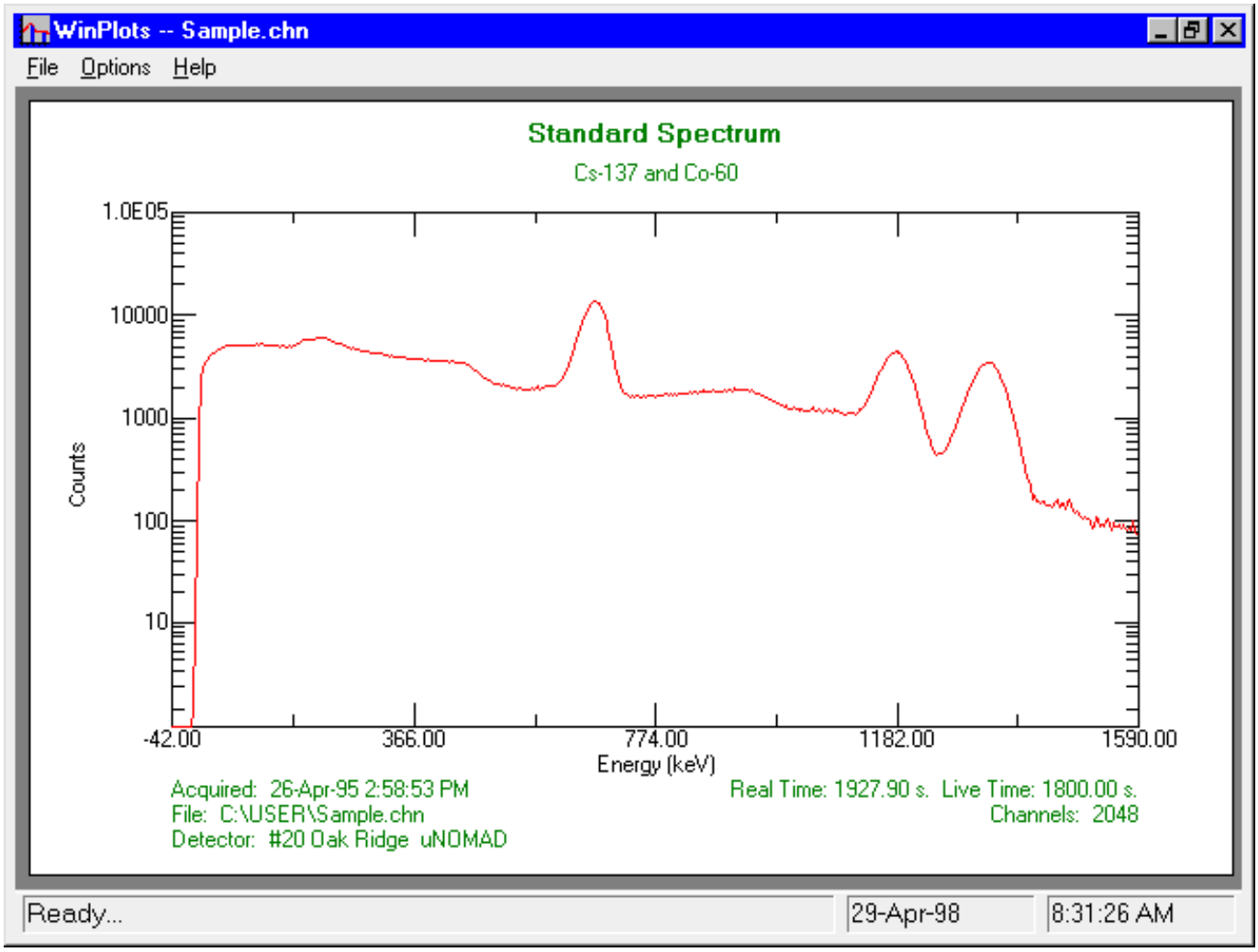


Fig. 216. The Main WINPLOTS Display.

11.1.1. File

Figure 217 shows the **File** menu. These menu items select the spectrum and ROI to be displayed, read and write the settings file, and actually make the plot.

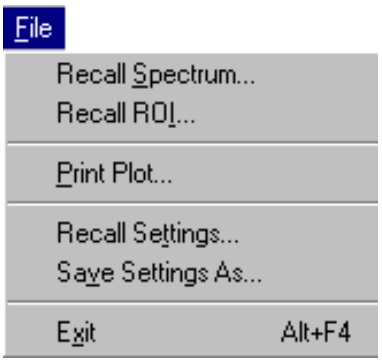


Fig. 217. The File Menu.

Once a file has been selected using the **Recall Spectrum...** function (see the file recall dialog shown in Fig. 218, it is automatically previewed using the current settings. This is the exact plot that will be printed. There are minor differences between display and printer fonts and colors.

The sample description, format, and number of channels are shown at the bottom of the dialog to aid in selecting the correct file.

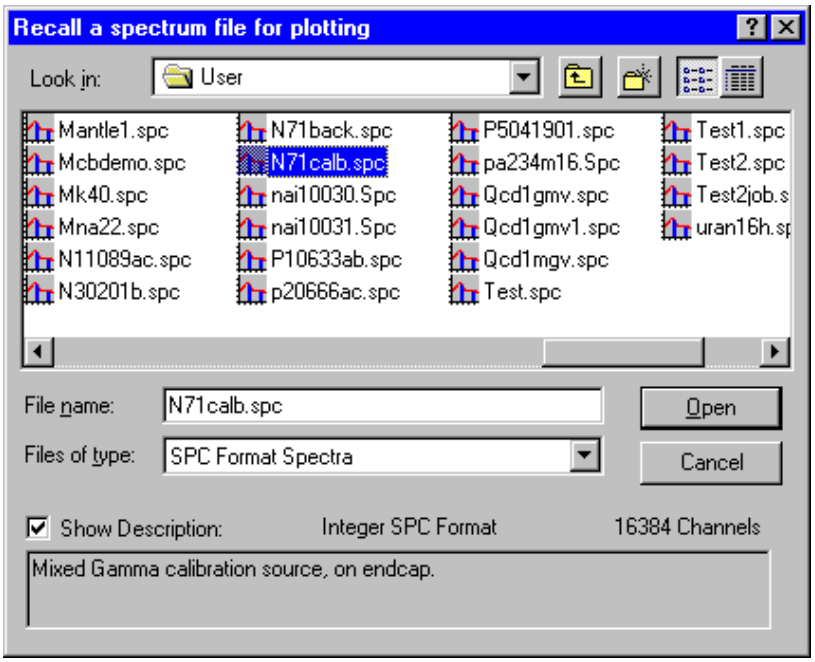


Fig. 218. The Recall Spectrum File for Plotting Dialog.

Figure 219 shows the **Recall a settings file** dialog. All of the settings specified on the **Options**/ **Plot...** dialog can be saved in the settings file. The file is saved in the **Save Settings** menu item. Various groups of settings can be saved and recalled here to make the desired plots or to be used in the command line mode.

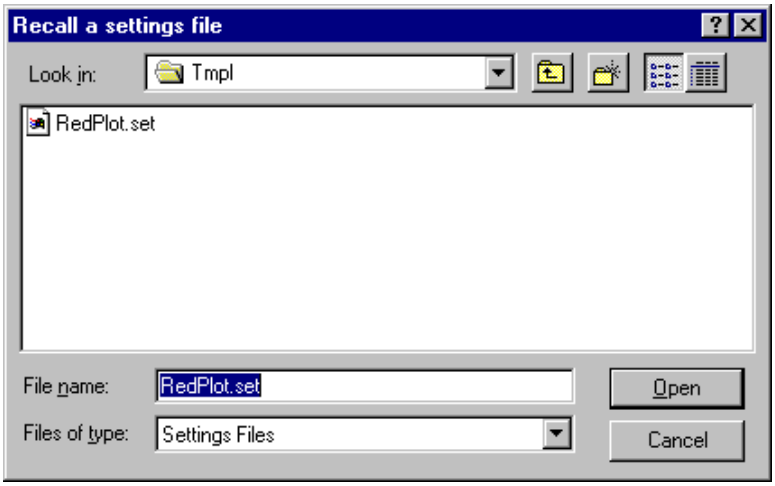


Fig. 219. The Recall a Settings File Dialog.

The **Print Plot...** dialog is shown in Fig. 220. The printer can be selected here from the list of available Windows printers. The **Properties** button displays a dialog for setting the printer properties, and is different for each printer. The number of copies can be selected to make multiple copies. This number is reset to 1 after every print session.

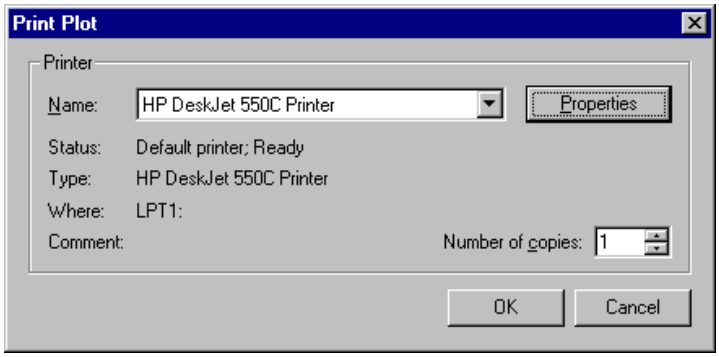


Fig. 220. The Print Plot Dialog.

11.1.2. Options

Fig. 221. The Options Menu.

The **Options** menu is shown in Fig. 221. These menu items control the plot settings and WINPLOTS operation.

11.1.2.1. Plot...

The **Plot Options** dialog is shown in Fig. 222. These settings are all stored in the default settings file and reloaded when WINPLOTS is next started. The **Title** is printed at the top of every plot (just above the sample description). If no title is specified, a default title is generated which is composed of the spectrum and ROI file names. The **Printer** is selected from the list of available printers in Windows.

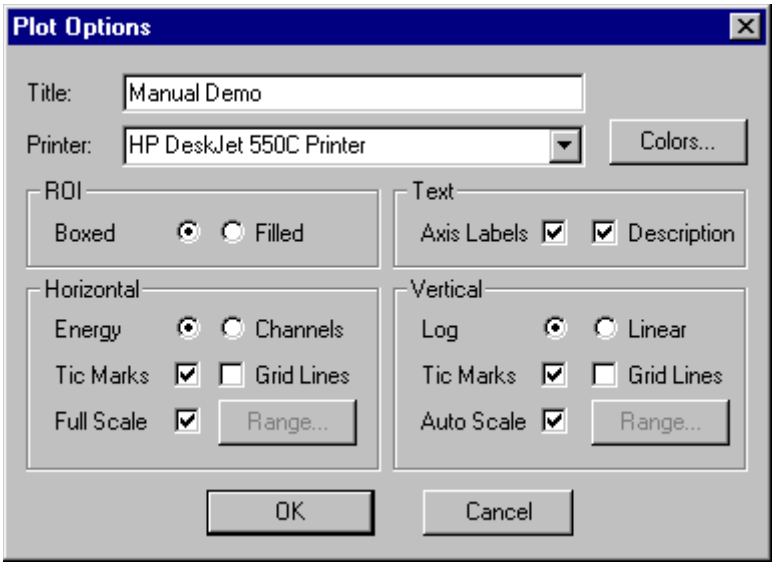


Fig. 222. The Plot Options Dialog.

If the printer supports color printing, the **Colors...** button will be enabled. Clicking on it will display Fig. 223. If monochrome prints are desired from a color printer, check the **Monochrome** box. The five different plot areas can have different colors. Select the desired color from the drop down list for each area. These are the Windows colors defined for the selected printer and might not duplicate the actual colors printed.

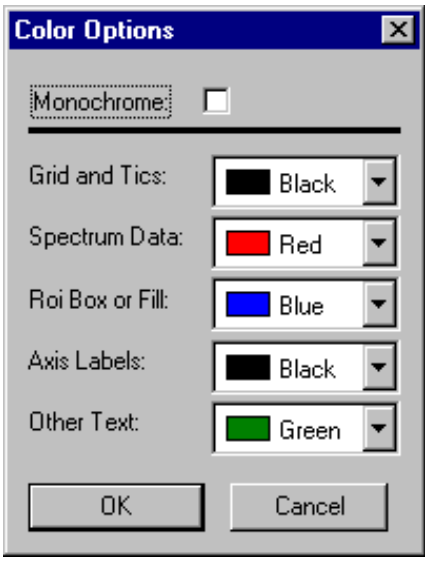


Fig. 223. The Color Options Dialog.

ROI

The ROIs can be **Boxed**, that is, represented as "boxes" drawn from the start to the stop channel (or energy) and from the baseline to above the spectrum. The **Filled** selection will "fill" the region under the spectrum data with a cross hatch. It is not completely filled in and does not extend above the data.

Text

The **Axis Labels** and the text **Description** from the file can be printed. The description includes the sample, detector, and acquisition description.

Horizontal

If the spectrum to be plotted is calibrated, the plot can be either in **Energy** or **Channel** numbers. If the spectrum is not calibrated, this value is set to channel and cannot be altered.

Tic Marks (small lines indicating the scale on the axes) can be included. Including them makes the plot more readable. **Grid Lines** can also be included. The grid lines are lines across the complete width of the plot at the major tic marks.

The plot can either be the complete spectrum or any part of the spectrum. Unmarking **Full Scale** will enable the **Range** button. Selecting **Range** will open the dialog shown in Fig. 224 where the limits for the plot are set. The range of the plot can be either in **Channels** or **Energy** (independent of the plot labeling). In order to easily compare spectra, the energy can be set to values below the first channel in the spectrum. In this case the data below channel 0 are plotted as 0.

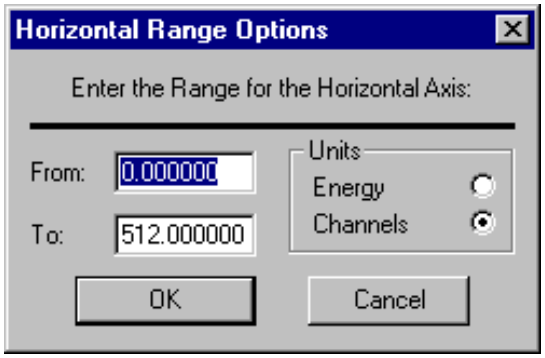


Fig. 224. Horizontal Range Options Dialog.

Vertical

One of the two choices, **Log** and **Linear**, can be selected by clicking on the appropriate radio button. The linear scale is set by clicking on **Range...**.

Tic Marks (small lines indicating the scale on the axes) can be included. Including them makes the plot more readable. **Grid Lines** can also be included. The grid lines are lines across the complete height of the plot at the major tic marks.

When **Auto Scale** is selected, the plot vertical axis is adjusted so that the largest count in the spectrum is near the top of the plot region.

When **Auto Scale** is clicked off, the **Range** button is enabled. Clicking on **Range** will display the dialog shown in Fig. 225.

The value entered will be the value for the top of the plotted region. Any counts above this value will be plotted at this value.

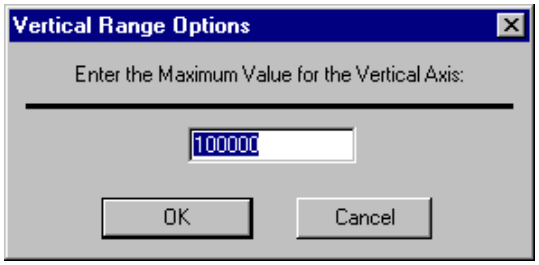


Fig. 225 Vertical Range Options Dialog.

11.1.3. Command Line Interface

The WINPLOTS Command Line Interface will support options available in the interactive mode as shown below:

```
WINPLT32<spectrum> -R <roi_file> -S <set_file> -P
```

where:

<spectrum>	Specifies the spectral data file (**.SPC**, **.An1**, or **.CHN**). The extension must be included.
-R <roi_file>	Specifies the **.ROI** file. The extension must be included.
-S <set_file>	Specifies the settings file. The extension must be included.
-P	Causes the program to print the plot and exit automatically. Used mainly in **.JOB** files or the Export function.

11.2. TRANSLT

The TRANSLT program (**TRANSLT.EXE**, located in **c:\Program Files\ScintiVision**) translates several different text files to and from **.SPC** or **.CHN** files. All operation is controlled from the command line. The command line is:

```
TRANSLT [-type] inname [[-type] outname] [-w] [-nc] [-col n] [-ni] [-nh] [-i]
```

where:

type

chn	The **inname** file is in CHN format.
spc	The **inname** file is in SPC format.
txt	The **inname** file is in ASCII text format.

The default is based on the filename extension and the **i** switch. Both **chn** and **spc** cannot be used together.

inname The input spectrum file, no default; default extension is **SPC**. If the input file is a **.TXT** file, it must contain the live and real time in the following format:

Real Time 240
Live Time 120

Both values are in seconds.

The header information in the **.TXT** file will be converted and stored in the **.SPC** file if it is in the correct format. The correct format for the **.TXT** input file is the same as the **.TXT** format created as the output file.

type

chn	The **outname** file is in CHN format.
spc	The **outname** file is in SPC format.
txt	The **outname** file is in ASCII text format.

outname The output spectrum file. The default is the **inname** with the extension changed. If the **outname** is not given, the spectrum file will not be overwritten by the default name. The length of the spectrum file converted from text will be the next higher power of two with the surplus channels set to 0.

w Set the format output to 128 characters per line; default is 70 characters per line.

nc Do not print channel as first number in line; default is to print the channel number. The channel number is followed by a colon (**:**) to separate it from the data.

col n Number of data columns is **n**; default is 5. Error returned if line width will exceed available space.

ni Do not write acquisition or analysis information in output file; default is to write this information.

nh Do not write header information in output file; default is to write this information.

i Import a text file and save as **.SPC** (or **.CHN**) file. If one filename is given, default is to convert that file to the other format, i.e., for **AAA.SPC**; the output will be **AAA.TXT**. If two filenames are given, the default is to convert the spectrum to text. The **.TXT** file will be overwritten even if the **.SPC** file is not located.

An example is:

```
TRANSLT -SPC GOODSPEC -TXT TEXTSPEC -ni -nh -col1
```

This will make a text file of one column with no header, no analysis information, and one channel per line.

For more comprehensive file-translation capabilities, use our DataMaster Spectrum File Format Translator (B49-B32), which allows you to import 16 spectrum file formats (including **.CHN** and **.SPC**) and translate them into 10 formats.

APPENDIX A. STARTUP AND CONFIGURATION

A.1. Startup

To start ScintiVision, go to the Windows **Start** menu and click on **ScintiVision 32**, **ScintiVision** (see Fig. 226). You can also start it by clicking on **Start**, **Run...**, and entering a command line in the **Run** dialog, with or without arguments as described below.

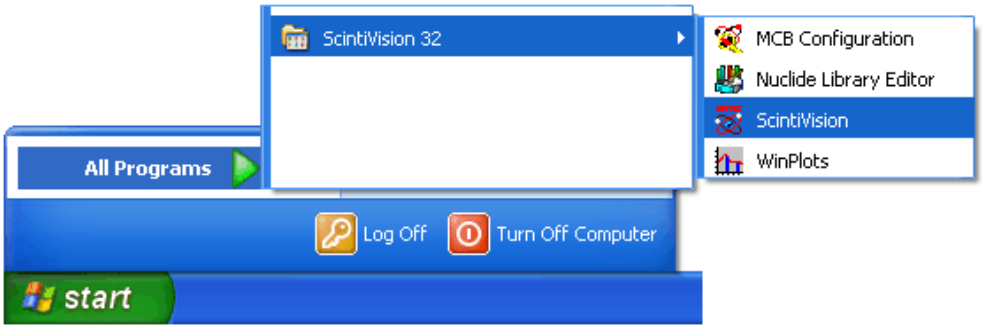


Fig. 226. Starting ScintiVision.

A.1.1. Command Line Options

ScintiVision is run with the following command line properties:

```
SCV [-B] [-d[n] [-L file.lib] [-l] [-p pick] [-t] [-z] [file.job]
```

All of the arguments are optional; one or more can be omitted. Thus, at a minimum, ScintiVision can be executed without any arguments at all, in which case certain defaults apply for the Detector list and nuclide library, as described below. All of the switches (e.g., **`-d`**, **`-z`**) can be uppercase or lowercase (e.g., **`-d`** or **`-D`**, **`-z`** or **`-Z`**).

`[n]` is an optional parameter for the **`-d`** switch to enable debugging output mode at a specified level (values are 1 or 2; no argument is equivalent to 1). Default is no debugging. Debug mode is not recommended for general use.

`file.lib` is an optional nuclide library (**`-L`** option) to be loaded at startup. The default is the library loaded when ScintiVision exited.

`pick` is an optional Detector pick list name (**`-p`** option). (The pick list name must be 5 characters or less; if none is specified with the **`-p`** option, then “MCA” is used by default.)

-t Forces ScintiVision to be "Always on Top." The default is the normal Windows display.

-l Allows one and only one instance to run.

-B Start-up in the buffer.

-z is the "zoom" switch with several variations:

- **-z** or **-z:** with no arguments, causes the previously stored "Zoom:" parameters (see page 238) to be used to position and size the ScintiVision window.
- **-z:x_0 y_0 w h** positions the upper left corner of the ScintiVision window to pixel coordinates (**x_0,y_0**) and sizes the window to width **w** and height **h** (these arguments are the same as for the "Zoom:" profile variables, page 239, 239).
- **-z0** forces position and size to be determined by Windows tiling algorithm.
- **-z+1** forces ScintiVision to be maximized.
- **-z-1** forces ScintiVision to be minimized (icon).

file.job is an optional **.JOB** file to be executed at start-up.

Certain defaults apply if any one or more of these arguments is omitted. The initial Detector list is named **MCA.CFG**. The nuclide library is assumed to be "**DEFAULT.MCB**" by default on MCBPATH or the last library used. And no JOB is automatically executed unless the **file.job** argument is included.

A.2. Analysis Setup

The default analysis engine (GSA) has several options that can be specified in a disk file (**G30WINDS.INI**). The report output text can also be specified in a disk file (**G30WIN.INI**). These files are loaded by SETUP, but if not found or cannot be read, the internal defaults are used. As supplied, the files are the same as the internal defaults.

These files should only be changed after careful consideration of the impact of the changes.

A.2.1. GSA Program

The GSA program performs the analysis of a complete spectrum. This analysis engine is run by ScintiVision and can also be run by other programs.

GSA reads the command line to control the analysis. The command line is:

```
GSA file.SPC [DEBUG] [file.INI]
```

file.SPC This is the spectrum filename and it must be the first argument. For a complete analysis it must contain all the analysis parameters and calibrations. The output files are the input file name with the extension of **.UFO** for the binary output and the extension of **.RPT** for the text output.

DEBUG This optional parameter controls the output of debugging information on the GSA window. ScintiVision sets this parameter when ScintiVision is run in debug mode. This produces considerable output and significantly slows the execution. It must be the second or third argument.

file.INI This optional file is the **.INI** file (such as **B30WINDS.INI**) for controlling the analysis. It overrides the normal default file. If the file cannot be found or read, the default file name is used. If the default file cannot be found or read, the internal options are used. By selecting different **.INI** files for different spectra, different analyses can be produced.

A.2.2. G30WINDS.INI

The **G30WINDS.INI** file contains initial or default values for the analysis done by GSA. It is read by GSA before the spectrum file is read. The contents are shown below. The filename can be specified on the command line. If the specified file cannot be found in the default directory (as defined by Windows) the **\MESSAGE** directory on the default drive is searched. If it is not found there or cannot be read, then the internal values are used. Some of these values can only be set in this file.

G30WIN.TXT Message file name

This is the name of the file containing all the text and format statements used in the report.

YES NO spellings

Not used in ScintiVision.

JANFEBMARAPRMAYJUNJULAUGSEPOCTNOVDEC spellings

These are the alternate (to English) spellings of the months. These spellings are used in addition to English to convert the input dates to fixed format.

D Deconvol. charact

This is the character on the report denoting that this peak is part of a deconvolution

s shape character

This character on the report means that the peak had a bad shape flag set to true.

M Multiplet char.

This is the character on the report denoting that this peak is part of a multiplet.

– Unknown suspect

Not used in ScintiVision.

D:\A27\EBAR.TBL Ebar table filename

Not used in ScintiVision.

D:\A27\IEQT.TBL IEq table filename

Not used in ScintiVision.

F Ebar on/off

Not used in ScintiVision.

F IEq on/off

Not used in ScintiVision.

T T=print eff cor peak area

Unidentified Peak and Library Table Format Flag

T = Print efficiency corrected peak area for unknown peaks instead of net peak count rate and include the nuclide half-life and peak yields in the Library Peak Usage section.

F = Print net peak count rate for unknown peaks instead of efficiency corrected peak area and omit the nuclide half-life and peak yields in the Library Peak Usage section.

15 # of pks/eng recal high (5 default)

Not used in ScintiVision.

0 # of pks/eng recal low

Not used in ScintiVision.

0.0 recal energy dividing

Not used in ScintiVision.

1.0 scaling factor on activity

Additional Scaling Factor. Scaling factor multiplied times nuclide activity in addition to the **Mulitiplier**, **Divisor**, and **Weight** values specified in the **`.SVD`** file.

2.0 range multiplier

Range multiplier for listing suspect nuclides in the unknown peak table. For peaks listed in the unknown peak table, the suspect nuclide in the unknown peak table is determined by choosing the closest energy match to the unknown peak that is within the Range Multiplier * FWHM of each peak.

60 Page length

Page length (in lines) of analysis report.

T F = erase **`.UFO`** file

Save UFO File Flag
T = Do not delete **`.UFO`** file after analysis is complete.
F = Erase **`.UFO`** file after analysis is complete.

09 T MDA type, T=Allow change

Not used in ScintiVision.

F **`PBCTEST.PBC`** PBC F=off and filename

PBC Flag
T = Use the PBC file specified here unless a different PBC file is given in the sample defaults. The file must include the full path and is limited to 32 characters total.
F = Do not use a PBC file unless one is specified in the sample defaults.

F **`d:\a27\MPCTABLE.MPC`** MPC F=off and filename

Not used in ScintiVision.

F T=do directed fit

Directed Fit Flag
T = Perform directed fit regardless of sample defaults setting.
F = Do not perform directed fit unless the option is turned on in the sample defaults.

F T=Halt GSA on error

Halt GSA on error. If false, GSA exits in all cases and the error reporting is in the device GVD (automatically read by ScintiVision). If true, GSA displays a dialog indicating an error, and you must close it before another analysis can be performed.

T T=accept low peaks

Keep or reject small peaks with bad peak shape. This should be set to true to report peaks in low background systems with few counts.

A Derived peak area char.

Derived Peak Area Character. Character displayed in the unidentified and identified peak summaries.

1.3 Multiplet FWHM limit

If two peaks are farther apart than the multiplet FWHM limit * FWHM, the analysis engine separates the peaks; otherwise, it is left as a multiplet.

T Adjust peak width and position

Allows the peak fit part of the program to adjust width and position of peaks found during the peak search. *In almost all cases, this should be set as true.*

F Add peaks in peakfit

Allows peak fit part of program to split peaks found in peak search into doublets, and add small peaks that might have been missed by peak search. *In almost all cases, this should be set as true.*

F Library based peak stripping

Not used in ScintiVision.

APPENDIX B. FILE FORMATS

This appendix describes the file structure for the database files. See the *File Structure Manual* for complete descriptions of the formats for these files, including **.SPC**, **.CHN**, and **.UFO** files. This appendix also includes two program examples that show how to access the spectrum files.

Our Analysis Results Programmer's Toolkit (A12-B32) can be used to develop user-written programs to read the analysis results.

B.1. ScintiVision File Types

B.1.1. DetectorPATH Files

.CFG "ConFiGuration;" System Detector configuration information used by **Detector.DLL**; modified by "Configuration" function; binary format.

.SCX "ScintiVisionConteXt;" a context file automatically created for each Detector/device to remember all extra information required for analyses, calibration, etc.; binary format.

.SVD "Sample type defaults;" Created in the **Analyze/Settings/Sample Type...** function; binary format.

.STR "STaRt;" Start Date/Time for Detector types which cannot store this information internally; binary format.

B.1.2. Spectrum Files

.CHN "CHaNnels;" Old MAESTRO-style spectral data file; binary format.

.SPC "SPeCtrum;" Spectrum with full analysis settings, calibration, descriptions, etc; "Inform" type binary format.

.AN1 Alternate name for spectrum files used for analysis, when the **.SPC** name is already in use; same format as **.SPC**.

.ROI "ROI;" channel pairs created by "ROI/Save" function; binary format.

B.1.3. Miscellaneous Analysis, Calibration, Library, and Text Files

.CLS "CaLibration;" full energy/efficiency calibration; "Inform" style binary format.

.LIB "LIBrary;" nuclide library; "Inform" style binary format.

.UFO "UnFormatted Output;" analysis results; "Inform" style binary format.

.EFT "EFficiency Table;" used for efficiency calibration "Recall" function and created by "Save" function; formatted ASCII text (also, lines that do not begin with numeric values are ignored).

.ENT "ENergy Table;" used for energy calibration "Recall" function (and created by "Save" function); formatted ASCII text (also, lines that do not begin with numeric values are ignored).

.RPT "RePorT;" output of "ROI Report" function; ASCII text.

.TXT "TeXT;" general ASCII text files used by "File/Print" et al.

.JOB ASCII text providing commands for "Services/JOB" function.

B.1.4. QA Database Files

.MDB Microsoft Access database file extension.

B.2. Database Tables for ScintiVision QA

B.2.1. QA Detectors Detector Table

(Only one of these tables for entire database; one record for each detector being monitored for QA, with fields defined as follows.)

Field Name	SQL Data Type	Description
Detector	SQL_INTEGER	Detector ID number. (Primary Key)
DetName	SQL_CHAR (32)	Detector Pick List Name
DetDesc	SQL_CHAR (64)	Detector Description
Creation	SQL_TIMESTAMP	Date/Time this record created
NumMeas	SQL_INTEGER	Measurement counter (all types) for this detector
NumBack	SQL_INTEGER	Background type only Measurement counter for this detector
SamFile	SQL_CHAR (64)	Sample Type File Name
SamType	SQL_CHAR (64)	Sample Type Description
LibFile	SQL_CHAR (64)	Nuclide Library File Name
Setup	SQL_SMALLINT	Setup Flagword
Limits	SQL_SMALLINT	Limit Settings Flagword
MinBack	SQL_REAL	Min. Background CPS Acceptance Limit

LowBack	SQL_REAL	Low Background CPS Excursion Warning Level
BigBack	SQL_REAL	High Background CPS Excursion Warning Level
MaxBack	SQL_REAL	Max. Background CPS Acceptance Limit
MinActivity	SQL_REAL	Min. Total Activity Acceptance Limit
LowActivity	SQL_REAL	Low Total Activity Excursion Warning Level
BigActivity	SQL_REAL	High Total Activity Excursion Warning Level
MaxActivity	SQL_REAL	Max. Total Activity Acceptance Limit
MinShift	SQL_REAL	Min. Average Peak Shift Acceptance Limit
LowShift	SQL_REAL	Low Average Peak Shift Warning Level
BigShift	SQL_REAL	High Average Peak Shift Warning Level
MaxShift	SQL_REAL	Max. Average Peak Shift Acceptance Limit
MinFWHM	SQL_REAL	Min. Average FWHM Ratio Acceptance Limit
LowFWHM	SQL_REAL	Low Average FWHM Ratio Warning Level
BigFWHM	SQL_REAL	High Average FWHM Ratio Warning Level
MaxFWHM	SQL_REAL	Max. Average FWHM Ratio Acceptance Limit
Operator	SQL_CHAR(64)	User's name last entered under ScintiVision's system dialog at start of latest measurement

B.2.2. Application Information Table

(One of these tables for entire database; one record for ScintiVision.)

Field Name	**SQL Data Type**	**Description**
ModelNumber	SQL_LONG	Product Model No.(i.e., 66)
SerialNumber	SQL_CHAR(32)	Product Serial No.
AppName	SQL_CHAR(16)	Application Name (i.e., "ScintiVision")
AppVersion	SQL_CHAR(8)	Version/Revision (i.e., "2.22" or greater)
Laboratory	SQL_CHAR(64)	Laboratory name entered under ScintiVision's system dialog

B.2.3. M...d Measurements Table(s)

(Where "...d" is the detector number in decimal from the Detectors table above). There is one of these tables for each detector, covering all measurements, whether background or standard sample type. The total number of records in this table is denoted by NumMeas in the Detectors table, which is also the measurement number of the last record in this table. The records are stored sequentially by measurement number.

Field Name	SQL Data Type	Description
Measurement	SQL_INTEGER	Measurement Number (Primary key)
MeasTime	SQL_TIMESTAMP	Date/Time for this measurement
MeasType	SQL_SMALLINT	Activity analysis (1) or Background (0)
LiveTime	SQL_REAL	Acquisition Live Time in Seconds
CountRate	SQL_REAL	Background CPS (only for Background measurement)
Activity	SQL_REAL	Total Activity
PeakShift	SQL_REAL	Average Peak Shift
FWHMRatio	SQL_REAL	Average FWHM Ratio

B.2.4. P...dmmmm Peaks Table(s)

(Where "...d" is the detector number in decimal, "mmmm" is the measurement number to 4 places). There is one of these tables for each measurement in the table above, but only if the output of actual centroid energies is enabled.

Field Name	SQL Data Type	Description
PeakNumber	SQL_INTEGER	Peak No. counter (Primary key)
Measurement	SQL_INTEGER	
PeakFlags	SQL_INTEGER	Analysis Results Flags
Nuclide	SQL_CHAR(8)	Library Nuclide Name this peak belongs to
Energy	SQL_REAL	Library Energy
Centroid	SQL_REAL	Actual Centroid Energy
CalFWHM	SQL_REAL	Expected (Calibrated) FWHM at this energy
FWHM	SQL_REAL	Actual FWHM
Area	SQL_REAL	Net counts in peak
Background	SQL_REAL	Background counts

B.3. Program Examples

The following examples show how to read **`.CHN`** data files and **`.ROI`** region-of-interest files. These are simple program segments to illustrate the programming details needed.

B.3.1. FORTRAN Language

This section contains two routines; one to access the **`.CHN`** files and one to access the **`.ROI`** files.

B.3.1.1. CHN Files

```
C This program prints the header data from a ScintiVision data file
C and the contents of a channel.
C
      INTEGER*2 TYPE,MCA,SEG,STRTCH,LNGTDT,SPCOUI(64)
      INTEGER*2 BEGREC,ENDREC
      INTEGER*2 TLRTYP,IS
      INTEGER*4 SPCIN(32),LVETME,RLTIME
      REAL*4 ENG(2),FW(2),X1
      CHARACTER*1 SRTTME(4),SRTSEC(2),SRTDTE(8),OUTPUT(30)
C
C    START
C
      WRITE(0,100)
100   FORMAT(29X,'SPECTRUM PRINT ROUTINE',//)
C  Open the spectrum file
      OPEN(1,FILE=' ',STATUS='OLD',ACCESS='DIRECT',RECL=32)
C  Read the first 32 bytes (first record) from the file
      READ(1,REC=1) TYPE,MCA,SEG,SRTSEC,RLTIME,LVETME,
     1 SRTDTE,SRTTME,STRTCH,LNGTDT
C  Check to see if the first word is a numeric -1, if not
C      then quit
      IF(TYPE.NE.-1) GO TO 1000
C  It's good, so write out all the data from the header,
C  note that the start time is split into two parts
      WRITE(0,150) TYPE,MCA,SEG,RLTIME/50,
     1  LVETME/50,SRTTME,SRTSEC,SRTDTE,STRTCH,LNGTDT
150   FORMAT(' TYPE = ',I4,' MCA # ',I2,' SEGMENT # ',
     1  I3,/,' REALTIME = ',I10,' SECONDS, LIVETIME = ',
     2  I10,' SECONDS',/,' DATA COLLECTED AT ',2A1,':',2A1,
     3  ':',2A1,' ON ',2A1,'-',3A1,'-',3A1,/,
     4  ' STARTING CHANNEL = ',I6,' NUMBER OF CHANNELS = ',
     5  I6,//)
C  The first trailer record is after the last channel data.
C  Divide the length by 8, because there are 8 channels per
C  record.
      LREC=3+(.CHNLEN-1)/8
C  Read the first trailer record. TLRTYP is the record type
C  The variables IS and X1 are dummys maintain the position
C  in the file.
      READ(LUN,REC=LREC,ERR=100)TLRTYP,IS,ENG(1),ENG(2),
     1  X1,FW(1),FW(2)
      WRITE(0,160) ENG,FW
160   FORMAT(' ENERGY ZERO = ',E14.8,/,' ENERGY SLOPE = ',
     1 E14.8,/,' FWHM ZERO = ',E14.8,/,' FWHM SLOPE = ',E14.8)
C  Ask the user for the channel number to print out
      WRITE(0,200)
200   FORMAT(' Enter channel number: ',\)
C  Get the channel number
```

```
      READ(0,210) I.CHNNL
210   FORMAT(I5)
C  Calculate the block of 8 channels that this one is in.
C  There are 8 channels in a record of 32 bytes.
      CHANEL=I.CHNNL-1
      ENDREC=CHANEL/8.
      BEGREC=CHANEL/8.
C  This is only one record in this example, but could be any
C  number of records. The 2 is the offset past the header
C  and the records start at 1. So the first data record is 2.
      DO 450 I=BEGREC+2,ENDREC+2
C  Read the 8 channels
        READ(1,REC=I) (SPCIN(K),K=1,8)
C  Print the 8 channels along with the channel number of
C  the first channel
        WRITE(0,410) 1+8*(I-2),(SPCIN(K),K=1,8)
410     FORMAT(1X,I5,8I9)
450   CONTINUE
      CLOSE(1)
1000  STOP
      END
```

B.3.1.2. ROI Files

```
INTEGER*2 LUNROI,LSTREC,IBEGIN,IEND
C
      WRITE(0,100)
100   FORMAT(29X,'ROI PRINT ROUTINE',//)
C  Open the ROI file
      OPEN(1,FILE=' ',STATUS='OLD',ACCESS='DIRECT',RECL=2)
C  Read the ROIs
      I=0
      IROI=1
C  Add 2 to skip past the header
200   READ(1,REC=I+2) IBEGIN
C  If the entry is 0 then this is the end of the list
      IF(IBEGIN.LE.0) GO TO 1000
C  If the beginning is there then the end is also
      READ(1,REC=I+3) IEND
C  But its one too many
      IEND=IEND-1
C  Write them all out
      WRITE(0,220) IROI,IBEGIN,IEND
220   FORMAT(' ROI # ',I3,' START ',I6,' STOP ',I6,)
C  Add 2 to I to advance past the begin and end numbers
      I=I+2
      IROI=IROI+1
C  Keep going until we run out of numbers
      GO TO 200
```

```
1000  STOP
      END
```

B.3.2. C Language

```
*************************************************************/
/*  Sample program compatible with Microsoft and Borland C  */
/*  to read header and channel data from a .CHN data file.  */
/*************************************************************/

#include <stdio.h>

#define  .CHN   -1

main(argc,argv)
   int   argc;
   char  *argv[];
   {
     char           acq_time[32];   /* buffer for time, date */
     int       f_type;          /* .CHN file type */
     unsigned int  chan_offset, /* beginning channel number */
               count,           /* loop counter */
               mca_num,         /* 1-4 are valid */
               num_chans,       /* no. of data channels */
               num_writ,        /* no. of bytes written out */
               segment;         /* segment number */
     long int  livetime,        /* 20ms tics of livetime */
               realtime,        /* 20ms tics of realtime */
               chan_data;       /* stores channel data */
     FILE           *f_pointer;

   if (argc != 2)
      {
      printf("USAGE:readchn filename.chn\n");
      exit(1);
      }

     f_pointer = fopen(argv[1],"rb");

/*************************************************************/
/*                        Header Data                        */
/*             Output header info from .CHN file             */
/*************************************************************/
/* Read filetype -1 (.CHN) */

   fread(&f_type,sizeof(int),1,f_pointer);
   if (f_type != .CHN)   {
      printf("Not a valid file\n");
      exit(1);
      }
```

```
   fread(&mca_num,sizeof(int),1,f_pointer); /* MCA number */
   fread(&segment,sizeof(int),1,f_pointer); /* segment #  */
   fread(acq_time+12,sizeof(char),2,f_pointer);/*start time */
   fread(&realtime,sizeof(long),1,f_pointer);/* 20ms ticks */
   fread(&livetime,sizeof(long),1,f_pointer);/* 20ms ticks */
   fread(acq_time,sizeof(char),2,f_pointer); /* start date */
   fread(acq_time+2,sizeof(char),3,f_pointer);/* start month*/
   fread(acq_time+5,sizeof(char),3,f_pointer);/* start year */
   fread(acq_time+8,sizeof(char),2,f_pointer);/* start hour */
   fread(acq_time+10,sizeof(char),2,f_pointer);/* start mins*/
   fread(&chan_offset,sizeof(int),1,f_pointer);/* offset */
   fread(&num_chans,sizeof(int),1,f_pointer);/* #channels  */

   printf( "TYPE = %4i MCA# %2i\n", f_type, mca_num );
   printf( "SEGMENT # %3i\n", segment );
   printf( "REALTIME = %10li SECONDS\n", realtime/50 );
   printf( "LIVETIME = %10li SECONDS\n", livetime/50 );

   printf( "DATA COLLECTED AT " );
   fwrite( acq_time+8, sizeof(char), 2, stdout );
   putchar(':');
   fwrite( acq_time+10, sizeof(char), 2, stdout );
   putchar(':');
   fwrite( acq_time+12, sizeof(char), 2, stdout );

   printf(" ON ");
   fwrite( acq_time, sizeof(char), 2, stdout );
   putchar('-');
   fwrite( acq_time+2, sizeof(char), 3, stdout );
   putchar('-');
   fwrite( acq_time+5, sizeof(char), 2, stdout );

   printf("\nSTARTING CHANNEL = %6in",chan_offset);
   printf("\nNUMBER OF CHANNELS = %6i\n\n",num_chans);

/*********************************************************/
/*                     Channel Data                      */
/*          Output channel data from .CHN file           */
/*********************************************************/

   printf("CHANNEL    DATA\n");
   for (count = 0; count < num_chans; count++)
      {
      if ((count % 6 ) == 0)        /* 6 channels per line */
          printf ("\n%7i",count);  /* with channel number */
      fread(&chan_data,sizeof(long),1,f_pointer);
      printf("%11i",chan_data);      }
   fcloseall();
 }
```

APPENDIX C. JOB FILE ERROR MESSAGES

Errors are displayed in warning boxes, or in some cases in the information line at the bottom of the window.

Acquisition Failure (JOB Error 11)
For some reason an acquisition function failed from a **.JOB** file.

Already started.
Detector already active when a Start Acquisition command was issued.

Altering Detector data.
Restoring data to a Detector would destroy the data already there.

Amplifier not pole-zeroed.
Warning from an MCB with automatic pole zero, indicating that the Detector should be pole-zeroed.

Analysis Completed for ...
GSA.EXE has finished executing.

Analysis Error <n>
A call to **GSADLL.DLL** has been completed, but an error was encountered. The error code <n> has the following meaning:

Error	Warning	Meaning
2	0	Illegal character in filename
3	0	Illegal date format
2	3	Tried to read an invalid file
2	7	Error writing header lines of report file
1	202	Error reading spectrum file
1	203	Invalid spectrum file type
1	3	Read error in analysis records of spectrum file
1	4	Read error in pbc file
1	4	Read error in ufo file
1	1	Error reading low energy peak invalid in ufo file
2	1	Error writing low energy peak invalid in ufo file
2	4	Peaks or nuclides out of order in ufo file
2	3	Error writing analysis records to ufo file

Error	Warning	Meaning
2	3	Write error to report file
4	3	Spectrum file not found
5	4	Spectrum file type not supported
1	3	Read error in spectrum file
6	1	Invalid nuclide pointer in library
6	2	Error reading nuclide in library
6	1	Invalid peak pointer in library
6	2	Error reading peak in library
7	1	"Analysis information not found"
7	2	"Array allocation error"
7	3	"Invalid analysis parameters"
7	4	"Invalid analysis parameters."
8	1	"Library too large"
8	2	"UFO file too large"
7	5	"Peak search error."
7	6	"No peaks found."
7	7	"Peak ID error"
7	8	"Isotope identification error"
7	9	"Floating point error"
0	0	"No Error"

Analysis Failed!

GSA.EXE has finished executing, but an error was encountered. Refer to the "GSA completion codes..." message.

Analyzing (Please Wait) ...

Analysis via **GSA.EXE** is being executed.

Attempt to dynamically link to a task! (WinExec error 5)

Error encountered trying to spawn **GSA.EXE** or some other application program.

Auto PZ aborted.

The MCB Auto PZ function was aborted (by <**Esc**>).

Buffer and Detector not same size or segments.
Error when trying to restore data which does not match the Detector configuration.

Calibration per channel wrong.
Error when trying to calibrate spectrum, arising whenever the calibration slope would be 0, negative or greater than 100 units per channel.

Can't allocate memory for library.
Attempting to load a library for which there is not enough room in memory. Best dealt with by trying again or removing some other applications from memory.

Can't find any more peaks!
A peak could not be found in the direction indicated by the function button pressed.

Can't Find Any More ROIs.
Attempting to index to the next ROI in a direction for which no more ROIs can be located.

Can't read library file.
Attempting to open or read the library file resulting in some kind of file I/O error, usually because the file doesn't exist, but also possibly because the disk is defective.

Can't RESTORE to acquiring Detector.
Error preventing the Restore function from altering data in a Detector in which one or more segment(s) are actively acquiring data.

Can't Run Protected Mode Application in Real Mode!
(WinExec error 18)
Error encountered trying to spawn **`GSA.EXE`** or some other application program.

Can't Run Second Instance of this .EXE (multiple writeable data segments)! (WinExec error 16)
Error encountered trying to spawn **`GSA.EXE`** or some other application program.

Can't Run Second Instance of this .EXE (Non-shareable DLL in use)! (WinExec error 17)
Error encountered trying to spawn **`GSA.EXE`** or some other application program.

Cannot get valid Spectral Data!
The File/Save function was not presented with valid spectral data; usually the result of problems obtaining data from a Detector.

Comm. Failure!

Detector communication failure, most likely resulting from a timeout (the Detector failed to respond within a reasonable period of time).

Configuration failed!

Attempted reconfiguration failed, most likely because of some conflict with Detectors physically installed.

Could not properly fit the peak.

Function requiring a fitted peak could not obtain an acceptable peak, probably because of too few counts, too narrow, or non-Gaussian peak shape, or bad statistics such as calculated sigma-squared less than zero.

Couldn't get background subtracted ROI.

A function requiring a background subtracted ROI couldn't obtain such, probably because there was no ROI at the point specified, or maybe because there weren't statistically significant counts above background.

Default Printer Failed! Undefined at Control Panel?

The REPORT or PRINT function was aborted because the default system printer has not been properly set up. Refer to the Control Panel "Printers" function; install the appropriate printer and select it as outlined in the Microsoft Windows documentation.

Detector #.. ; ..... ; Error ... (Macro) ... (Micro)

An unresolved error originating in the Detector. The offending Detector command is shown, together with the macro and micro error codes. If the error persists, the error codes should be recorded and the factory should be contacted. These error codes are explained in the hardware manual for the Detector.

Detector busy or Segment not responding.

This indicates the Detector was unable to respond within a certain time limit, due to other activities, such as multiple instances of ScintiVision accessing the Detector at the same time, or otherwise heavy use of the Detector interface.

Detector Error!

The selected Detector could not be STARTed or STOPped due to some unresolved error condition.

Detector Not Located.

A Detector could not be located at the configured address.

Do you want to save buffer?
A function that would destroy the buffer (such as COPY or EXIT) queries you unless the buffer has not been modified since last being saved.

Do you want to save Library?
The nuclide library has been modified by the library editor, but you have not yet saved the changes.

DOS 4.0 Application! (WinExec error 13)
Error encountered trying to spawn **`GSA.EXE`** or some other application program.

Error opening file.
If trying to write a file, this would indicate a disk controller problem such as a full disk. If trying to read a file, this would indicate that the filename specified could not be found.

Error reading file -- STRIP aborted.
Could not read the file requested for stripping.

Error reading file.
File read error is usually a result of damaged media.

Error writing file.
File write error is usually a result of damaged media or full disk.

.EXE for earlier version of Windows! (WinExec error 15)
Error encountered trying to spawn **`GSA.EXE`** or some other application program.

Failure obtaining ROI (or Peak).
A function that requires a defined ROI (or Peak, in the case of the Calibrate function) when the marker is not placed in a channel with an ROI bit set (and if a Peak is not very close by).

Failure of Detector function (JOB Error 12)
This error arises from a JOB that encounters an error when trying to access a Detector.

File already exists!
If the file output function requested would write a file with the same name as another file that already exists, you are prompted for confirmation of the operation by this warning. See also “OK To Overwrite Existing File?”.

File is wrong size -- Can't STRIP.

The STRIP function requires a compatible file for stripping from the spectrum in memory; i.e., must contain the same number of channels.

File Not Found! (WinExec error 2)

Error encountered trying to spawn **GSA.EXE** or some other application program.

Fine gain is at limit of ...

This message appears in the Information Line when an attempt is made to change the MCB gain setting with the keyboard function, but while the MCB cannot be decreased or increased any further.

FWHM Fit Error Exceeds 25%.

The peaks entered in an energy calibration produced a FWHM fit with an error on at least one peak greater than 25%.

Hardware failure!

This message appears as the result of a Detector execution error with micro code 137, indicating a hardware failure.

High voltage not enabled.

START was attempted on a MCB while the High Voltage was not enabled.

Illegal Entry!

Certain values are not permitted in manual dialog entries or tables.

Illegal Detector.

The Detector number for the requested function was not identifiable as part of the active configuration.

Illegal Segment. (JOB Error 15)

A JOB tried to specify a Segment number which was invalid for the selected Detector or buffer.

Incorrect Windows Version! (WinExec error 10)

Error encountered trying to spawn **GSA.EXE** or some other application program.

Insufficient memory.

System memory has been exhausted. Usually, this error arises when the buffer cannot be created due to insufficient available memory in the system. Sometimes this error can be eliminated by attempting the buffer operation again, but this is not recommended due to the marginal state of the system, which might result in other errors.

Invalid Command or Missing Argument. (JOB Error 4)

A syntax error in a JOB, meaning that a command could not be interpreted; usually the result of misspelling.

Invalid Device or Segment!

This message arises as a result of a Detector execution error with micro code 134, indicating that an invalid device or Segment was selected.

Invalid .EXE file! (WinExec error 11)

Error encountered trying to spawn **`GSA.EXE`** or some other application program.

Invalid File Format!

A function to recall a file could not obtain data in the proper format.

Invalid library format!

An attempt was made to load a nuclide library from a file which was not in the proper format.

Invalid LOOP count. (JOB Error 7)

The LOOP statement could not be executed properly in a JOB.

Invalid Start Date/Time -- Battery Backup Lost??

A Detector contained an unrecognizable start date. This is usually an indication that the backup power was lost.

Invalid Start Record.

No valid Start Record file could be found to provide the start date/time for an installed 917 or 918 Detector.

JOB Aborted or Premature EOF (JOB Error 1)

A JOB was aborted by the user, or an End-Of-File was encountered while trying to obtain a command from the executing **`.JOB`** file.

JOB Error.
A generic error message indicating that an error was encountered while executing a **`.JOB`** file. Usually some explanatory phrase is given.

Library requires separate data segments for each task!
(WinExec error 6)
Error encountered trying to spawn **`GSA.EXE`** or some other application program.

Library too large to load.
Library files larger than 65,000 bytes are not admissible as internally resident libraries. (However, any size library can be used for Master Library.)

Must have a value greater than zero!
Certain analysis or library table entries require values greater than 0.0.

Must have valid calibration!
Certain analysis functions cannot be performed if the calibration is invalid.

Need an ROI at the desired peak location.
The Stabilizer function requires a valid ROI at the desired peak.

No Buffer to RESTORE from!
The RESTORE function requires a valid spectrum in buffer.

No close library match.
The REPORT function could not obtain a library entry close enough to the located peak.

No File Name.
A file function was requested without specifying the filename adequately.

No more library peak energies!
A peak search was attempted in a direction where no more can be found.

No more multiplets!
The multiplet finding sidebar function in Analysis Results display mode cannot find any more multiplets in the direction indicated.

No more peaks for this nuclide!
The “peaks within nuclide” sidebar function in Analysis Results mode cannot find any more peaks within the selected nuclide.

No more unknown peaks!
The unknown peak finding sidebar function in Analysis Results display mode cannot find any more unknown peaks in the direction indicated.

No peaks found!
The peak search function could not find any valid peaks in the spectrum.

No ROI found to report!
The REPORT function could not find any ROIs in range.

No ROI There To Clear.
The ROI Clear function (DEL key) requires at least one channel at the marker with the ROI bit set.

No segment selected.
The Detector function could not be performed because no Segment was selected.

No Start Channel Was Defined.
The ROI "End" function was attempted without properly performing the "Begin" function.

Not Allowed During Acquisition!
An execution error (micro 135) arising from the Detector, indicating that the Detector command is not allowed while acquisition is in progress.

Not Allowed During Current Mode!
An execution error arising from the Detector (micro 136), indicating that the Detector command attempted is not allowed in the current mode of operation.

Not enough data points for fit.
Efficiency calibration fit for specified type requires a minimum number of table entries for that type; e.g., for a polynomial fit, six or more points are required.

Not enough memory -- STRIP aborted.
The STRIP function temporarily allocates enough memory to read the file, but the allocation failed in this case, probably due to insufficient available memory in the system. The STRIP function is discontinued.

Not enough memory for COMPARE.
The COMPARE mode could not be executed due to insufficient memory for the second spectrum.

OK to overwrite '...' ?

A file output function discovered that the specified filename already exists, and will only overwrite the file after you confirm that it should be overwritten. See also "File already exists!"

OK to save changes?

You are being prompted to allow the system to save a modified library file, table file, or sample type defaults file, etc.

OK to use it anyway?

A new configuration was applied but failed due to some conflict with the Detectors physically present; it is possible to use the configuration anyway by answering Yes to this query.

OS/2 Application! (WinExec error 12)

Error encountered trying to spawn **GSA.EXE** or some other application program.

Out of Memory! (WinExec error 0)

Error encountered trying to spawn **GSA.EXE** or some other application program.

Path Not Found! (WinExec error 3)

Error encountered trying to spawn **GSA.EXE** or some other application program.

Peak rejected for asymmetry.

Peak statistics could not be obtained for the function due the calculated non-Gaussian asymmetry of the obtained peak.

Preset already reached.

Acquisition START was attempted on a Detector or Segment which had already satisfied the preset condition(s) in some way.

Presets can't be changed during acquisition.

Changes in the preset condition(s) are not allowed while the Detector is actively acquiring.

Presets not programmed to Detector correctly!

Usually a failure of the selected Detector to accept the commands from ScintiVision to program presets. Often the result of improper configuration or faulty interface.

Previous analysis did not run to completion!

Attempt to start an analysis (via **GSA.EXE**) while a previous analysis has not yet finished, or had been aborted abnormally. See "OK to attempt another instance?"

Problem with Buffer. (JOB Error 2)
A JOB error resulting from some problem with a buffer, usually indicating insufficient memory to create or enlarge a buffer as needed.

Problem with Calculation. (JOB Error 13)
A JOB error resulting from a problem with a calculation.

Problem with RECALL. (JOB Error 10)
The RECALL statement could not be executed in a JOB.

Problem with REPORT. (JOB Error 14)
The REPORT function could not be exercised in a JOB.

Problem with SAVE. (JOB Error 9)
The SAVE function could not be executed in a JOB.

Sample Changer Hardware Failure. (JOB Error 16)
The Sample Changer hardware handshake failed in some way; usually the result of too much time before SAMPLE READY is obtained.

Start/Save/Report sequence aborted!
Start/Save/Report sequence aborted (usually by manual intervention, but also resulting from certain errors.)

Start/Save/Report waiting for completion of previous analysis...
A status message indicating that the Start/Save/Report sequence has been suspended while waiting for completion of an ongoing analysis.

Token Error.
A token error in a JOB, meaning that some argument to the command was invalid or out of context.

Unable to CALL -- Invalid file name. (JOB Error 8)
A JOB error resulting from a problem with the CALL function (usually because the file does not exist).

Unable to COMPARE files of different sizes.
The COMPARE function requires compatible files.

Unable to cut peak or peak not selected!

The Library Editor "Cut" function or Analysis Results "Delete" library peak function is complaining that it cannot cut or delete a peak from the library for some reason, usually because a peak is not selected.

Unable to open file -- STRIP aborted.

The STRIP function is aborted if the file cannot be read.

Unable to open file for COMPARE.

The COMPARE function is aborted if the second spectrum cannot be read.

Unable to Read Specified File. (JOB Error 3)

A file input/output error encountered while executing a JOB.

Unable to RUN non-executable program. (JOB Error 6)

The specified program could not be RUN from a JOB.

Unable to strip Detector memory.

The stripping function must be performed in the buffer.

Unknown (misspelled) Command. (JOB Error 5)

A command in a `.JOB` file could not be executed because it could not be interpreted as a valid command (usually a result of misspelling).

Warning 128.
Warning 64.
Warning 8.

All three of the above messages are the result of Detector Start or Stop warnings and are hardware dependent.

Warning: Buffer was modified.

When ScintiVision is being closed, this message will appear if the buffer spectrum has been modified but not yet saved to disk. This gives you the chance to save the buffer.

Warning: File Changes.

The table editor sensed that modifications were made, but you have not saved the file. See "OK to save changes?"

Warning: Library was modified.

The library was edited or modified for analysis but not yet written to a file. See "OK to save changes?"

Warning: Sample Type Defaults changed

Sample type defaults have been modified but not yet written to selected file. See "OK to save changes?"

WinExec() Error <n>!

Error encountered trying to spawn **`GSA.EXE`** or some other application program; refer to Windows SDK documentation for meaning of code <n>.

INDEX

.AN1 255
.CFG 255
.CHN 48, 255
.CLB 23, 111
.CLS 230, 255
.CXT 255
.EFT 104, 256
.ENT 20, 97, 256
.JOB 256
.LIB 142, 255
.PBC 129
.ROI 255
.RPT 256
.SEQ 93, 110
.SPC 111, 255
  floating-point 48
  integer 48
.STR 255
.SVD 255
.TXT 256
.UFO 256
??? (Job loop counter) 227
Accelerator keys 201
  keyboard map 203
  quick-reference table 202
acceptance thresholds 192
Acquire menu 59
Acquisition presets
  ask on start 61
  live-time 75
  MDA 76
  real-time 75
  ROI integral 75
  ROI peak count 75
  uncertainty 75
Acquisition settings 60
Activity 176
ADC 2
ADC setup 69
Always on Top 250
Amplifier gain
  fine 206
Analog-to-Digital Converter (ADC) 2
Anticoincidence 69, 84
Arguments
  export 50
  import 52
Ask on Save 211
Ask on Start 61, 211
  acquisition presets 61
  collection date and time 61
  sample description 61
  sample quantity 61
  sample type defaults 61
Associated files 43
Auto mode (in InSight mode) 83
Automatic vertical scale 35, 159
B30WIN.INI 250
Background 167, 168
Background Fit 170
Baseline Restorer 84
Branching ratio (yield) 176
buffer 3, 62, 163
  Detector/Buffer 159
Calculate menu 112
Calibration 93, 97, 98, 101, 104
  Automatic 105
  certificate 22
  efficiency 21, 99-102, 105, 178, 225, 230
  energy 18, 94, 95, 97, 142, 230
  internal 119
  sequence 110
  working 111, 119
Center 36, 160
Changing drive 41
Clear ROI 164
Clear spectrum 62, 226
Coincidence 69, 84
Collection date and time 49
  ask on start 61
COMBINE 161
command line 249
Compare spectra 57, 161, 202
Copy to buffer 62
Correction 124
  PBC 124

Count rates 66, 67
Critical Level 169
Cross-Correlation 168
Cubic fit 103
Dead time 27, 66, 75, 84
Decay correction 49, 100, 118, 176
Decay Limit Test 176
Deconvolution 184
Delay 83
detector 3
  background, QA 189
  database, QA 189
  detector table 256
  Detector/Buffer 159
  list 250
  lock 153
  pick list 32, 157
  setup 25
  status sidebar 33
  unlock 153
Detector list 32, 157
digiBASE 77
  ADC setup 78
  amplifier settings 77
  conversion gain 78
  gain 77
  gain stabilizer 79
  gating 78
  gating - Enable 78
  gating - Event 78
  high-voltage setup 80
  InSight mode 77
  lower level discriminator 78
  presets 81
  shaping time 77
  Status tab - Enable Counter 81
  upper level discriminator 78
  zero stabilizer 79
Directed fit 173
Directories
  file locations 54
Display
  mode (points/fill) 160, 161
  spectrum colors 161
Display menu 157
Drag and drop 42
DSPEC jr 2.0
  ADC setup 69
  amplifier settings 65, 67
  anticoincidence 69
  coincidence 69
  gating 69
  high-voltage setup 70
  live-time preset 75
  low-frequency rejector (LFR) 68
  lower level discriminator 69
  MDA preset 76
  optimize 66
  overflow preset 75
  preamplifier type 66
  real-time preset 75
  ROI integral preset 75
  ROI peak count preset 75
  stabilizer setup 70
  uncertainty preset 75
  upper level discriminator 69
  zero dead-time (ZDT) mode 69
Edit detector llist 154
Efficiency calibration 93
Enable counter (digiBASE) 81
Energy calibration 93
Energy graph 95
Energy table 95, 97
Exit 59
Expanded Spectrum View 32, 33
Export
  arguments 50
  file 50
  setup 50
  spectrum 56
File
  export 50
  import 52
  location 54
  recall spectrum 54
  save spectrum 55
File Dialog 40
File menu 48
File settings 48
  collection date and time 49

sample description 49
sample quantity 49
Fine gain 206
Flattop 68, 83, 85
Tilt 66, 68, 85
Width 67, 68, 85
Fraction Limit Test 175
Full Spectrum View 33
Sizing and moving 38
FW(1/x)M 112
FWHM 20, 170, 183
G30WINDS.INI 250, 251
Gain
fine 206
Gain stabilization 70
Initialize 70
Gain Stabilizer 85
Gating 69, 84
GSA.DLL 250
Half-life 103
Help
Question mark (?) 42
What's This? 41
high voltage 26, 70
Horizontal Scale 209
Center 36
InSight mode 83
zoom 37
Zoom In 35
Zoom Out 36
Import
arguments 52
file 52
setup 52
spectrum file 57
Indexing buttons 39
LIB 39, 204
PEAK 39, 204
ROI 40, 204
InSight Mode 67, 68, 85
Mark 83
Mark types 84
Integration time 67
Job
commands; detailed reference 223
commands; quick reference 212
control 150
edit 151
example 219
file 211
file variables 218
loop counter (???) 221
programming 219
run 150
subroutine 226
Keyboard
commands 201
map 203
quick reference 202
Library 96, 97, 105
edit 23, 144
edit peaks 148
load 143
Master 145
menu 142
nuclide flags 147
old 143, 149
photon flags 148
print 150
show peaks 143
Working 143, 145
working library 119
Linear fit 103
Linear scale 35
Live time 75
Lock detector 153
master password 153
Lock/Unlock
Detectors 153
Log mode 83
Logarithmic scale 35
Lower level discriminator (LLD) 69
Mark (InSight mode) 66, 83, 84
Mark ROI 155, 156, 164
MARK_PEAKS (Peak search) 229
Marker 33
moving with the mouse 36
MCA Emulation 2
MCA.CFG 250
MCB

Select 157
MDA 177
MDA preset 76
Menu
Acquire 59
Calculate 112
Display 157
File 48
Library 142
master password 152
right-mouse-button 37, 163
ROI 155
Services 150
Menu bar 31
Minimum Detectable Activity 177
Mouse 36
moving the marker 36
Right-mouse-button menu 37, 43
rubber rectangle 37
MultiChannel Analyzer (MCA) 2
Multichannel buffer (MCB) 2
Net Area 170
Noise 66
Notepad 97, 134, 135
Offset 83
Optimize 66, 85, 236
Passwords 151, 190
menu 151
PBC 129, 178
Peak
Activities 176
Fitting 170
Identification 175
peak centroid 184
peak search 229
Search 167
Statistics 169
Peak area
directed fit 173
Peak Background Correction (PBC)
turning on the correction 124
Peak Info 113, 164
Peak Rejection Criteria 169
Peak Search 229
Peaked Background Correction (PBC) . . 129, 178
create table, automatic 131
create table, manual 130
select 130
PHA 2
PHA mode 83, 84
Pileup reject marker 84
Poisson Noise Statistics 177
pole zero 27, 66, 68, 85, 236
automatic 27
Preamplifier type 66
Presets - see Acquisition presets 74
Print
library 150
spectrum 57
QA - see Quality assurance 189
Quadratic fit 103
Quality assurance 189
activity 189
ANSI N13.30 and N42.14 189
background 189
background measurement 195, 229
control chart 197
database 193
FWHM ratio 189
Lock Acquire on Violation(s) 190
peak shift 189
sample measurement 196, 229
settings 190
status 196
Real time 75
Recalibration 100
Recall
load library 143
read spectrum 54
ROI file 157
Region of interest - see ROI 155
Resistive Feedback 66
Resolution 67, 68, 84, 85
Right-mouse-button menu 37, 163
Clear 163
Clear ROI 164
Copy to Buffer 163
Mark ROI 164
Peak Info 164
Start acquisition 163

Stop acquisition 163
Undo Zoom In 164
Zoom In 163, 164
Zoom Out 164
Rise time 67, 68, 85
ROI 40, 155, 204
Clear 156, 164, 205
Clear All 156
Mark 155, 156, 164, 205
Mark Peak 156
Off 155
Recall File 157
Save File 156
status 32, 208
Unmark 155
ROI menu 155
ROI Status 32, 208
Rubber rectangle 37, 164
Sample changers 238
Sample description 49, 151
ask on start 61
Sample quantity 49
ask on start 61
Sample Type
corrections 124
Save
library 149
ROI file 156
spectrum 55, 57
Scaling
autoscale 35, 159
linear 35, 159
logarithmic 35, 159
Screen Capture 207
segments 3
Select MCB 157
SEND_MESSAGE 233
Serial-port MCBs 238
Services menu 150
Settings
acquisition 60
Calculate 112
File 48
quality assurance 190
setup
analysis setup 250
detector 25
quality assurance 190
Start/Save/Report 60
Shaping 83
Singlets 101
SMART-1 detector 72
Smooth 116, 236
Source 99-102, 110
Source Strength 100, 109
SPC file
floating-point 48
integer 48
Spectrum 32
Spectrum translation 247
Stabilizer
gain 85
Start acquisition 62
Start/Save/Report 62
setup 60
State of health (SOH) 72
Status sidebar 33
Stop acquisition 62
Strip 116
stripping factor 116
Sum 115, 165
Throughput 67, 68, 84, 85
Time constant 66
Title Bar 31
Toolbar 32
Transistor Reset 66
Transistor Reset Preamplifier 27
TRANSLT program 247
command line 247
Uncertainty 169, 176
Uncertainty preset 75
Undo Zoom In 164
Unlock detector 153
Upper level discriminator (ULD) 69
Vertical Auto Scale 35, 159
Vertical Scale 205, 206
InSight mode 83
linear 35, 159
logarithmic 35, 159
zoom 37

warning limits 192
Yield 176
ZDT mode 87
    view ZDT spectrum 63
zero dead time - see ZDT mode 69
Zero stabilization 70, 86
    Initialize 70
Zoom 33, 37
Zoom In 35, 159
Zoom Out 36, 159